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ISO Technical Committee ISO/TC 184, *Industrial automation systems and integration*,
Subcommittee SC4, *Industrial data*

SC4 Supplementary directives — Rules for the structure and drafting of SC4 standards for industrial data

This standing document cancels and replaces
the Supplementary directives for the drafting and presentation of ISO 10303 (SC4 N537).

This standing document is applicable with immediate effect to all SC4 projects.

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SC4 standing documents specify procedures, methods, and guidelines for the development of SC4 standards for industrial data. SC4 standing documents, together with additional documents such as templates and checklists, can be obtained from the Internet:

`<http://www.nist.gov/sc4/www/necsdocs.htm>`

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

This standing document was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data*.

The following standing documents provide guidelines for developing International Standards produced by ISO/TC 184/SC4:

- ISO/TC 184/SC4 Organization handbook;
- SC4 Quality manual;
- SC4 Supplementary directives.

The following standing documents provide additional guidelines for developing parts of ISO 10303 “Product data representation and exchange”:

- Guidelines for application interpreted construct development;
- Guidelines for application interpreted model development;
- Guidelines for the development and approval of STEP application protocols;
- Guidelines for the development of abstract test suites;
- Guidelines for the development of mapping specifications.

This standing document cancels and replaces the Supplementary directives for the drafting and presentation of ISO 10303 (SC4 N537).

This SC4 standing document is applicable with immediate effect to all SC4 projects.

0 Introduction

0.1 Overview of this standing document

This standing document specifies requirements for the content, layout, and style for the standards developed by ISO TC184/SC4.

This standing document augments the 1997 edition of ISO/IEC Directives, Part 3 and does not supersede it.

This standing document is subdivided into clauses as follows:

- scope and field of application of this standing document;
- additional documents that, through references in this standing document, constitute provisions of this standing document;
- definitions of terms used in this standing document;
- the structure of SC4 standards;
- the format and layout of SC4 standards;
- rules and guidelines for documenting EXPRESS schemas;
- rules and guidelines for documenting the integrated resources series of ISO 10303;
- rules and guidelines for documenting the application interpreted construct series of ISO 10303;
- rules and guidelines for documenting the application protocol series of ISO 10303;
- preliminary rules and guidelines for documenting the abstract test suite series of ISO 10303;
- rules and guidelines for documenting parts of ISO 13584;
- rules and guidelines for documenting parts of ISO 15531;
- rules and guidelines for documenting parts of ISO 15926;
- rules and guidelines for documenting parts of ISO 18629;
- rules and guidelines for documenting parts of ISO 18876;
- rules and guidelines for documenting parts of ISO standards produced jointly with other ISO or IEC committees.

This standing document is partially derived from the 1997 edition of the ISO/IEC Directives Part 3 - *Rules for structure and drafting of international standards*¹⁾ that specifies the general requirements, form, and language for the production of an International Standard. This standing document includes

¹⁾ A fourth edition of the ISO/IEC Directives Part 2 (which supersedes Part 3:1997) is to be published in 2001. This standing document is also consistent with the requirements of the fourth edition.

requirements specific to the standards developed by SC4. Some of these requirements apply to all SC4 standards; others are specific to ISO 10303. The ISO/IEC Directives Part 3 and these Supplementary Directives provide the set of rules for creating an SC4 standard.

0.2 Changes from the previous edition

The main changes with respect to the Supplementary directives for the drafting and presentation of ISO 10303 (SC4 N537) are listed below.

- The scope has been widened to include requirements that are applicable to all SC4 standards. Placeholders have been included for future inclusion of provisions that apply specifically to standards other than ISO 10303.
- Requirements for layout and presentation have been separated from those that apply to content.
- The provisions of this document have been updated to conform to those of the 1997 edition of the ISO/IEC Directives, Part 3.
- The provisions of this document have been updated to include additional guidance provided by the ISO Central Secretariat.
- Several sections of the document have been merged in order to reduce duplication and redundancy.

A complete list of changes is available in the standing document ballot issues log ISO TC184/SC4/QC N132 together with the documents “Impact of standing document ballot issue resolutions on the Supplementary Directives” (QC N132) and “Detailed changes to the Supplementary Directives for ISO 10303” (QC N180).

0.3 Target audiences

This document is intended for use by editors of SC4 standards, and by developers of, for example, DTDs, style sheets, and templates related to SC4 standards.

0.4 Characteristics of a standard

Standards communicate to identified target users a technical specification that is unambiguous to the extent that two parties who

- have not taken part in developing the standard, and
- are not working together

can create implementations of the standard (normally software) that conform to the stated requirements of the standard and are mutually consistent. Producing a standard means developing drafts that must be technically accurate and communicate the information the intended users need.

Project teams are responsible for developing a standard whose scope is defined by an approved New Work Item. The team produces drafts of the proposed standard and revises them based on industry reviews, ballot results, and ballot comments. Figure 1 summarizes team activities to produce a standard. Several levels of reviews happen before the document goes for balloting:

- internal project reviews;

- reviews by industry sponsors/participants;
- “wide industry reviews” (previously referred to as Committee Draft for Comment)
- peer review by other experts in the same Working Group (common in some of SC4’s working groups, including WG10, WG11, and WG12).

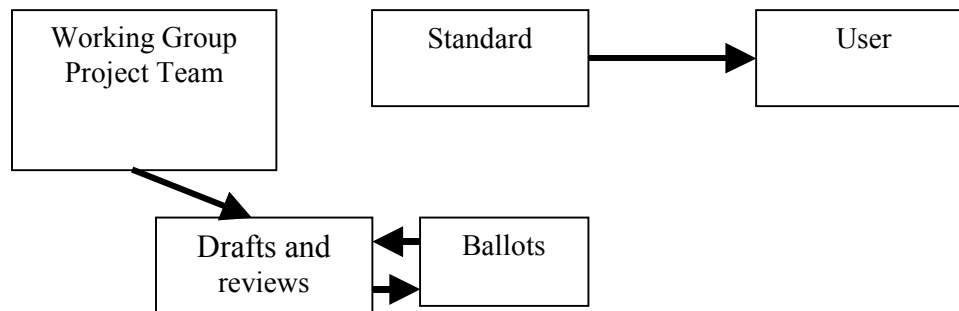


Figure 1 — Model of situation in creating a standard.

The following points summarize key factors that project teams should take into account when preparing a draft standard.

- Treat writing the draft as a process that involves a series of recursive steps (preparing and planning, researching, organizing, drafting, and revising).
- Treat the user profile as the driving force behind all writing decisions.
- Understand what the user needs to know.
- Help the user understand the material through definitions, visuals, writing style, and reduction of ambiguities.
- Know what the users will do or what the team wants the users to do with the material.
- Ask that there be as many reviews for expression as there are for technical content.

SC4 Supplementary directives — Rules for the structure and drafting of SC4 standards for industrial data

1 Scope

This standing document specifies requirements for the content, layout, and style for the standards developed by ISO TC184/SC4. These standards include the following:

- ISO 10303 Product data representation and exchange;
- ISO 13584 Parts library;
- ISO 15531 Manufacturing management data;
- ISO 15926 Integration of life-cycle data for process plants including oil and gas production facilities;
- ISO 18629, Process specification language;
- ISO 18876 Integration of industrial data for exchange, access, and sharing.

This standing document specifies the elements that make up SC4 standards, provides wording to be used to prepare those elements, and sets out rules for the appearance of those elements.

NOTE 1 In this standing document, the term “SC4 standard” is used to refer to any of the deliverables of SC4 projects that are published by ISO. This includes International Standards, Technical Specifications, Publicly Available Specifications, and Technical Reports.

NOTE 2 Directions for the preparation of Technical Corrigenda are specified in the Procedures for development and approval of Technical Corrigenda

The following are within the scope of this standing document:

- specification of rules and guidelines that apply to preliminary elements (see 3.3.2);
- specification of rules and guidelines normative elements (see 3.3.1);
- specification of rules and guidelines supplementary elements (see 3.3.3);
- guidelines for formatting the elements of the standard.

The following is outside the scope of this standing document:

- the technical content of SC4 standards.

2 Normative References

The following documents contain provisions which, through reference in this text, constitute provisions of this standing document. For dated references, subsequent amendments to, or revisions of,

such publications do not apply. However, editors of SC4 standards are encouraged to investigate the possibility of applying the most recent editions of the documents indicated below. For undated references, the latest edition of the document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 690:1987, *Documentation — Bibliographic references — Content, form and structure*.

ISO 690-2:1997, *Information and documentation — Bibliographic references — Part 2: Electronic documents or parts thereof*.

ISO 8601:1988, *Data elements and interchange formats — Information interchange — Representation of dates and times*.

ISO 10303-1:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles*.

ISO 10303-11:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual*.

ISO 10303-202:1996, *Industrial automation systems and integration — Product data representation and exchange — Part 202: Associative draughting*.

ISO 10241:1992, *International terminology standards — Preparation and layout*.

IEEE Std 1320.1-1998, *Standard for Functional Modeling Language - Syntax and Semantics for IDEF0*.

IEEE Std 1320.2-1998, *Standard for Conceptual Modeling Language - Syntax and Semantics for IDEF1X*.

IEC/ISO Directives, Part 3, *Rules for the structure and drafting of International Standards*, Third edition, 1997

THOMPSON, Della (ed). *The Concise Oxford English Dictionary of Current English*. 9th ed. Oxford: Oxford University Press, 1995.

The following SC4 standing documents contain provisions, which, through reference in this text, constitute provisions of this standing document. At the time of adoption, the revisions of the documents indicated were valid. All documents are subject to revision, and users of this standing document are encouraged to investigate the possibility of applying the most recent revisions of the documents indicated below.

ISO TC 184/SC4 N534:1997, *Guidelines for application interpreted construct development*.

ISO TC 184/SC4 N532:1997, *Guidelines for application interpreted model development*.

ISO TC 184/SC4 N535:1998, *Guidelines for the development and approval of STEP application protocols*.

ISO TC 184/SC4:—²⁾, *Guidelines for the development of abstract test suites*, edition 2.

ISO TC 184/SC4, *Guidelines for the development of mapping tables*, N533, 1997.

²⁾ To be published. (Revision of ISO TC184/SC4 N536:1997)

ISO TC184/SC4:—³⁾, *Guidelines for the development of mapping specifications*.

NOTE A list of current SC4 standing documents and other material to be used by developers of SC4 standards is available from the Internet:

`<http://www.nist.gov/sc4/www/necsdocs.htm>`

3 Terms, definitions, and abbreviations

3.1 Terms defined in ISO 10303-1

For the purpose of this standing document, the following terms defined in ISO 10303-1 (repeated below for convenience) apply.

3.1.1

application activity model (AAM)

model that describes an application in terms of its processes and information flows

3.1.2

application interpreted model (AIM)

information model that uses the integrated resources necessary to satisfy the information requirements and constraints of an application reference model, within an application protocol

3.1.3

application object

atomic element of an application reference model that defines a unique concept of the application and contains attributes specifying the data elements of the object

3.1.4

application reference model (ARM)

information model that describes the information requirements and constraints of a specific application context

3.1.5

conformance class

subset of an application protocol for which conformance may be claimed

3.1.6

interpretation

process of adapting a resource construct from the integrated resources to satisfy a requirement of an application protocol. This may involve the addition of restrictions on attributes, the addition of constraints, or the addition of relationships among resource constructs

3.1.7

product data

a representation of information about a product in a formal manner suitable for communication, interpretation, or processing by human beings or by computers

³⁾ To be published. (Revision of ISO TC184/SC4 N533:1997; see [19] for the draft submitted for standing document ballot.)

3.1.8**resource construct**

a collection of EXPRESS ENTITIES, TYPES, FUNCTIONS, RULES, and REFERENCES that together define a valid description of an aspect of product data

3.1.9**unit of functionality (UoF)**

a collection of application objects and their relationships that defines one or more concepts with the application context such that removal of any component would render the concepts incomplete or ambiguous

3.2 Terms defined in ISO 10303-202

For the purpose of this standing document, the following term defined in ISO 10303-202 (repeated below for convenience) applies.

3.2.1**application interpreted construct (AIC)**

a logical grouping of interpreted constructs that supports a specific function for the usage of product data across multiple application contexts

3.3 Terms defined in ISO/IEC Directives, Part 3

For the purpose of this standing document, the following terms defined in ISO/IEC Directives Part 3 (repeated below for convenience) apply.

3.3.1**normative elements**

elements setting out the provisions to which it is necessary to conform in order to be able to claim compliance with the standard

3.3.2**preliminary elements**

elements that identify the standard, introduce its content and explain its background, its development and its relationship with other standards

3.3.3**supplementary elements**

elements that provide additional information intended to assist the understanding or use of the standard

3.4 Other terms and definitions**3.4.1****abstract test suite (ATS)**

part of ISO 10303 that contains the set of abstract test cases necessary for conformance testing of an implementation of an application protocol

NOTE Adapted from ISO 10303-1.

3.4.2**application protocol (AP)**

part of ISO 10303 that specifies an application interpreted model satisfying the scope and information requirements for a specific application

NOTE 1 This definition differs from the definition used in open system interconnection (OSI) standards. However, since ISO 10303 is not intended to be used directly with OSI communications, no confusion should arise.

NOTE 2 Adapted from ISO 10303-1.

3.4.3

common resource

part of an SC4 standard that defines a group of resource constructs that can be used or interpreted in other SC4 standards

NOTE 1 The constructs defined in a common resource may be used or interpreted in all other SC4 standards or in a subset of the other SC4 standards.

NOTE 2 Common resources include the integrated resources, application interpreted constructs, and application modules parts of ISO 10303, together with a number of designated parts of other SC4 standards such as ISO 13584-20 and ISO 15531-42.

3.4.4

implementation method

part of ISO 10303 that specifies a technique used by computer systems to exchange product data that is described using the EXPRESS language

NOTE Adapted from ISO 10303-1.

3.4.5

integrated resource (IR)

part of ISO 10303 that defines a group of resource constructs used as the basis for product data

NOTE Adapted from ISO 10303-1.

3.5 Abbreviations

For the purposes of this standing document, the following abbreviations apply.

AAM	application activity model (see 3.1.1)
AIC	application interpreted construct (see 3.2.1)
AIM	application interpreted model (see 3.1.2)
AP	application protocol (see 3.4.2)
ARM	application reference model (see 3.1.4)
ATS	abstract test suite (see 3.4.1)
CD	Committee Draft
DIS	Draft International Standard
(E)	English
FDIS	Final Draft International Standard
IR	integrated resource (see 3.4.5)

IS	International Standard
ISO	International Organization for Standardization
SC4	Subcommittee 4
TC 184	Technical Committee 184
UoF	unit of functionality (see 3.1.9)
WD	working draft

4 Requirements for the structure and content of parts of SC4 standards

Table 1 lists the elements that comprise the content of parts of SC4 standards.

Table 1 — Arrangement of elements

Type of element	Arrangement of elements ^a in standard	Permitted content of elements ^b in standard
Informative preliminary	<i>Cover page^c</i>	Title Text
	<i>Table of contents</i>	(generated content; see 4.1.2)
	<i>Foreword</i>	Text <i>Note(s)</i> <i>Example(s)</i> <i>Footnote(s)</i>
	<i>Introduction</i>	Text <i>Figure(s)</i> <i>Table(s)</i> <i>Note(s)</i> <i>Example(s)</i> <i>Footnote(s)</i>

Table 1 — Arrangement of elements (continued)

Type of element	Arrangement of elements in standard	Permitted content of elements in standard
Normative general	Title	Title
	Scope	Text <i>Figure(s)</i> <i>Table(s)</i> <i>Note(s)</i> <i>Example(s)</i> <i>Footnote(s)</i>
	Normative references ^d	Reference(s) <i>Footnote(s)</i>
Normative technical	Term(s) and definition(s) Symbols and abbreviated terms Requirements ^d ... Normative annex ^d	Text <i>Figure(s)</i> <i>Table(s)</i> <i>Note(s)</i> <i>Example(s)</i> <i>Footnote(s)</i>
Informative supplementary	<i>Informative annex^e</i>	Text <i>Figure(s)</i> <i>Table(s)</i> <i>Note(s)</i> <i>Example(s)</i> <i>Footnote(s)</i>
	<i>Bibliography</i>	Reference(s) Footnote(s)
	<i>Index</i>	generated content (see)

Table 1 — Arrangement of elements (concluded)

Type of element	Arrangement of elements ^a in standard	Permitted content of elements ^b in standard
^a	Bold type = required element; upright type = normative element; italic type = informative element.	
^b	Upright type = required content; italic type = optional content	
^c	The final cover page is generated by the ISO Central Secretariat	
^d	Each part of ISO 10303 shall contain a normative references clause, at least one requirements clause, and at least one normative annex. These elements may not be required for parts of other SC4 standards.	
^e	Informative annexes may not contain normative elements unless these elements constitute optional provisions. For example, a test method that is optional may contain provisions.	

NOTE Some elements are optional in the ISO/IEC Directives Part 3, but are mandatory for all SC4 standards. For example, all SC4 standards are required to include an introduction and one index.

Many of the elements require specific wording. To identify required text clearly from the rest of the text in this document uses the following conventions:

- Required text is enclosed in a box.
- All text that is required in each ISO standard begins with “*[ISO required]*” and ends with “*[end required]*”.
- All text that is required in each SC4 standard begins with “*[SC4 required]*” and ends with “*[end required]*”.
- All text that is required in each part of ISO 10303 begins with “*[ISO 10303 required]*” and ends with “*[end required]*”.

The part editor provides the information requested within angle brackets (< >).

SC4 has agreed with ISO Central Secretariat that the parts of each SC4 standard shall be prepared only in the English language. Translations to other languages may be made only after the part has achieved Draft International Standard (DIS) status.

4.1 Preliminary elements

Preliminary elements are those elements that introduce a standard. A list of preliminary elements for parts of SC4 standards is given in Table 1.

4.1.1 Cover page

The ISO Central Secretariat will prepare the final cover page. For all stages prior to IS or TS publication, each SC4 standard shall have a cover page that summarizes the status of the SC4 standard in the standardization process. This serves as a cover for the SC4 standard until ISO prepares the official version, and shall be attached to all documents distributed for comment.

The requirements specified in 4.1.1.1, 4.1.1.2, and 4.1.1.3 apply to all SC4 standards. The requirements specified in 4.1.1.4 only apply to parts of ISO 10303.

4.1.1.1 Contents of the cover page

The cover page shall contain the following information:

- the N-number (assigned by a working group or by SC4) that identifies the document;
NOTE See the SC4 Quality manual [24], 7.2, for information on N-numbers.
- the N-number that identifies the previous version of the document (if any);
- the document reference (see 5.2.1, Table 5);
- the document title (see 4.2.2);
- the date on which the document is published or distributed;
- a copyright statement (see 4.1.1.2);
- information about the approval status of the document (see 4.1.1.3);
- an abstract that summarizes the content of the standard using the concepts and wording of the scope clause;
- a list of keywords that can be used in an information retrieval system to indicate the content of the standard;

The cover page may contain the following additional information:

- contact information for the project leader and part editor;

NOTE SC4 encourages the inclusion of this contact information; however, in accordance with the ISO Technical Management Board's policy on privacy the project leader or part editor may elect to omit this information.

- information telling readers where and how comments against the document can be submitted.

4.1.1.2 Copyright information to be included on the cover page

The cover page shall include copyright information. Use the following wording for working draft and Committee Draft documents:

[SC4 required]

This ISO document is a working draft or Committee Draft and is copyright protected by ISO. While the reproduction of working drafts or Committee Drafts in any form for use by Participants in the ISO standards development process is permitted without prior permission from ISO, neither this document nor any extract from it may be reproduced, stored or transmitted in any form for any other purpose without prior written permission from ISO.

Requests for permission to reproduce this document for the purposes of selling it should be addressed as shown below (via the ISO TC 184/SC4 Secretariat's member body) or to ISO's member body in the country of the requester.

Copyright Manager
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New York, New York 10036
USA
phone: +1-212-642-4900
fax: +1-212-398-0023

Reproduction for sales purposes may be subject to royalty payments or a licensing agreement.

Violators may be prosecuted.

[end required]

NOTE Throughout this standing document text to be included in SC4 standards is distinguished by being enclosed in a box.

For Draft International Standards or Final Draft International Standards the following is mandatory for the front of this cover page:

[ISO required]

This ISO document is a <insert "Draft International Standard" or "Final Draft International Standard" as appropriate> and is copyright-protected by ISO. Except as permitted under the applicable laws of the user's country, neither this ISO draft nor any extract from it may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, photocopying, recording, or otherwise, without prior written permission being secured.

Requests for permission to reproduce should be addressed to ISO at the address below or ISO's member body in the country of the requester:

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Tel. + 41 22 749 01 11
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E-mail copyright@iso.ch

Reproduction for sales purposes for any of the above-mentioned documents may be subject to royalty payments or a licensing agreement.

Violators may be prosecuted.

[end required]

4.1.1.3 Required text for approval status

Use the following wording to indicate the review(s) and approval(s) that apply to the document.

NOTE 1 The “Comments to reader” section of the cover page template in annex A can be used for this information.

NOTE 2 Procedures for review and approval of SC4 standards are specified in the SC4 Organization handbook [23] and the SC4 Quality manual [24].

Use the following if a document is being distributed after the internal review has been completed but before the project leader and convener reviews have been done:

[SC4 required]

This document has been reviewed using the internal review checklist (see <N- number of completed checklist>).

[end required]

Use the following if a document is being distributed after the internal review and project leader have been completed but before the convener review has been done:

[SC4 required]

This document has been reviewed using the internal review checklist (see <N- number of completed checklist>) and the project leader checklist (see <N- number of completed checklist>).

[end required]

NOTE 3 SC4 does not require publication of documents at these intermediate points in the review and approval process; see the SC4 Quality manual [24] for details of the review, approval, and publication procedures.

Use the following wording when the document has completed the review and approval process and is being submitted for ballot or publication:

[SC4 required]

This document has been reviewed using the internal review checklist (see <N- number of completed checklist>), the project leader checklist (see <N- number of completed checklist>), and the convener checklist (see <N- number of completed checklist>), and has been determined to be ready for this ballot cycle.

[end required]

In the last case, if the document is ready for publication (IS or TS) rather than balloting, substitute the phrase “... and has been determined to be ready for publication”.

These wording forms should be used after a document has been through the note review stage(s); do not, for example, put the text from the boilerplate preceding NOTE 3 above in the comments to reader if the document is being submitted for convener review.

4.1.1.4 Additional requirements for parts of ISO 10303

A sample cover page is presented in annex A of this standing document. Use this sample as the basis for the cover page for each part of ISO 10303.

NOTE Instructions for completing the cover page along with an electronic version of the cover page are located at the following URL:

<<http://www.nist.gov/editing/cover/>>

4.1.2 Copyright statement

The ISO Central Secretariat will prepare the reverse of the final cover page (page ii). For all stages prior to IS or TS publication, each SC4 standard shall include a copyright notice at the bottom of page ii. Do not place other text (apart from the standard header and footer) on this page. The text for the copyright notice is follows:

[ISO required]

© ISO <year of publication>

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56. CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 734 10 79
E-mail copyright@iso.ch
Web www.iso.ch

[end required]

4.1.3 Table of contents

The table of contents shall begin on page iii. The title of the table of contents element shall be "Contents". The table of contents lists the clauses, higher level subclauses, annexes, the bibliography (if present), and the index.

NOTE In this standing document, the term "subclause" is used to refer to any subdivision of a clause or annex, independent of its level. For example 4.1 and 4.1.1.3 are both referred to as "subclauses".

If the document includes figures, there shall be a list of figures titled "Figures". If the document contains tables, there shall be a list of tables titled "Tables". If both these latter elements are included, the list of figures shall precede the list of tables.

The list of clauses begins with an entry for the scope clause and includes the complete title of each clause and higher-level subclause in the main body of the document and the page number on which each begins. Except for ISO 10303 application protocols and abstract test suites, the table of contents shall contain entries to the second level of subclause (to the subsubclause level) of the document. See 9.1 for requirements that apply to the table of contents of an AP and 10.2 for those that apply to the table of contents of an ATS. The table of contents does not include the terms defined in clause 3 of the standard.

The list of annexes shall include the complete title of each annex and the number of the page on which each begins (see 4.3.2.4.4). The index entries in the table of contents shall have the following form:

<ISO required>

Annex <letter> (<normative or informative>) <Annex title>

<end required>

NOTE This form is required by ISO/IEC Directives Part 3:1997 and differs from that prescribed in earlier versions of the Directives. Do not use older standards as examples.

If the document includes a bibliography, list this in the table of contents and include the number of the page on which the bibliography begins.

The last entry in this section of the table of contents is for the index and includes the page number on which the index begins.

The list of figures shall include the number, complete title, and page number of each figure.

The list of tables shall include the number, complete title, and page number of each figure.

NOTE See annex C for an example of a table of contents.

The table of contents shall be generated automatically and not set manually.

4.1.4 Foreword

The foreword shall appear in each standard. It shall not contain requirements, figures or tables. It consists of a general part (supplied by the ISO Central Secretariat) and a specific part (supplied by SC4). The wording to be used in the foreword depends on the type of the standard and its status.

NOTE The text of the foreword may be amended by the ISO Central Secretariat prior to publication as an International Standard or Technical Specification.

The following instructions outline which paragraphs are required and which are optional. Each description is followed by the wording to be used to compose that part of the foreword. Any information not covered by the text described here does not belong in the foreword. Place additional introductory material about the standard in the introduction (see 4.1.5).

4.1.4.1 Wording for the foreword of International Standards

The required wording for the foreword of all SC4 standards that are to be published as International Standards is subdivided as follows:

- common text that is to be included at the beginning of the foreword (see 4.1.4.1.1);
- additional text that is to be included in the foreword of second or subsequent editions of SC4 standards (see 4.1.4.1.2);
- common text that is to be included at the beginning of the foreword (see 4.1.4.1.3).

See 4.1.4.2 for requirements for the foreword of documents that are to be published as ISO Technical Specifications or as ISO Publicly Available Specifications.

4.1.4.1.1 Common text for the beginning of the foreword

The following wording has been supplied by the ISO Central Secretariat and is required in all parts of SC4 standards.

[ISO required]

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/ IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO <ISO standard number> may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO <ISO standard number>-<part number> was prepared by Technical Committee ISO TC184/SC4, *Industrial automation systems and integration*, Subcommittee SC4 *Industrial data*.

[end required]

NOTE The use of italics shown here is required.

4.1.4.1.2 Requirements for second and subsequent editions only

If the part is a second (or subsequent) edition, add one of the following paragraphs following the text prescribed above.

If the new edition cancels and replaces its predecessor, use the following (modify the supplied wording as appropriate if the part is a third or subsequent edition):

[ISO required]

This second edition of ISO <ISO standard number>-<part number> cancels and replaces the first edition (ISO <ISO standard number>-<part number>:<year of publication>), of which it constitutes a technical revision.

[end required]

If the previous edition is to be retained, use the following (modify the supplied wording as appropriate if the part is a third or subsequent edition):

[ISO required]

This second edition of ISO <ISO standard number>-<part number> constitutes a technical revision of the first edition (ISO <ISO standard number>-<part number>:<year of publication>), which is provisionally retained in order to support continued use and maintenance of implementations based on the first edition and to satisfy the normative references of other parts of ISO <ISO standard number>.

[end required]

NOTE SC4 has elected to retain the first editions of some ISO 10303 parts. In general, any edition will be cancelled by its successor; any exceptions to this should be considered and approved by SC4 resolution(s) that justify the retention of previous editions.

If the revisions to the document affect only specific elements of the document, add text based on the following. If the new edition cancels and replaces the previous edition, substitute the following for the text given above:

[ISO required]

This second edition of ISO <ISO standard number>-<insert part number> cancels and replaces the first edition (ISO <ISO standard number>-<part number>:<year of publication>), clause(s)/subclause(s)/table(s)/figure(s)/annex(es) of which has/have been technically revised.

[end required]

If the previous edition is retained, add an additional sentence to the paragraph previously prescribed:

[ISO required]

This second edition of ISO <ISO standard number>-<insert part number> constitutes a technical revision of the first edition (ISO <ISO standard number>-<insert part number>:< year of publication>), which is provisionally retained in order to support continued use and maintenance of implementations based on the first edition and to satisfy the normative references of other parts of ISO <ISO standard number>. Clause(s)/subclause(s)/table(s)/figure(s)/annex(es) of the first edition has/have been technically revised.

[end required]

Details of the changes to the part should be provided in the introduction (see 4.1.5), not the foreword.

If the part (second or subsequent edition) incorporates corrections previously published as one or more Technical Corrigenda, add a sentence listing the Technical Corrigenda covered, using the following as a model:

[ISO required]

This edition incorporates the corrections published in ISO <ISO standard number>-<part number>:<year of original IS publication>/Cor. 1:<year of TC publication> ...

[end required]

If any Technical Corrigendum has been defined but not yet published, replace its year of publication by a long dash (“emdash”) and add a footnote stating that it is to be published.

4.1.4.1.3 Common text for the end of the foreword

The next paragraph to be included in the foreword for all SC4 standards explains the structure of the standard and refers to the list of all parts, using the URL form mandated by ISO 690-2. Use the following wording for all parts of ISO 10303:

[ISO 10303 required]

This International Standard is organized as a series of parts, each published separately. The structure of this International Standard is described in ISO 10303-1.

Each part of this International Standard is a member of one of the following series: description methods, implementation methods, conformance testing methodology and framework, integrated generic resources, integrated application resources, application protocols, abstract test suites, application interpreted constructs, and application modules. This part is a member of the <provide series name> series.

[end required]

If the part is a member of either of the integrated resources series, add the following sentence to the end of the preceding paragraph.

[ISO 10303 required]

The integrated generic resources and the integrated application resources specify a single conceptual product data model.

[end required]

Then introduce the URL that references the complete list of parts of ISO 10303 (generated from the SC4 database and held on SOLIS), using the following text.

[ISO 10303 required]

A complete list of parts of ISO 10303 is available from the Internet:

<<http://www.nist.gov/sc4/editing/step/titles/>>

[end required]

Other SC4 standards shall include similar text to describe their structure and reference a list of parts. Projects should consult the SC4 Secretariat and the Quality Committee to determine the URL to be used to reference the list of parts.

The last paragraph of the foreword lists the annexes found in the document.

Use the appropriate choice from the following wording, expanding the number of annexes as required:

[ISO required]

Annex(es) <list of normative annex(es)> form(s) a normative part of this part of ISO <ISO standard number>. Annex(es) <list of informative annex(es)> is (are) for information only.

[end required]

If there are no annexes of either type, do not include the corresponding sentence.

See ISO/IEC Directives, Part 3, 6.3.8 and 6.4.1 for explanations of annexes. See 4.2.7 and 4.3.1 for general requirements that apply to annexes of all SC4 standards. See 7.5, 8.5, and 9.9 for requirements that apply to parts in the integrated resources, application interpreted constructs, and application protocols series of ISO 10303.

NOTE An example page showing the layout and content of the foreword of a part of ISO 10303 that is to be published as an International Standard is included in annex C.

4.1.4.2 Wording for the foreword of Technical Specifications

The requirements specified above for the content and required text in the foreword apply to documents that will be published as International Standards. ISO also publishes Technical Specifications, Publicly Available Specifications, and Technical Reports.

NOTE At this time, SC4 has elected only to make use of the Technical Specification documentation form – this is being used for Application Modules (ISO 10303- 1xxx parts) and for other specifications that either have an urgent market need (such as ISO 10303-28) or are being published as “experimental standards” (such as ISO 18876-1 and -2). ISO 10303 Abstract Test Suites are also published as Technical Specifications.

Use the following required wording for the foreword of an ISO Technical Specification.

NOTE This wording also applies to Publicly Available Specifications.

[ISO 10303 required]

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50% of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed every three years with a view to deciding whether it can be transformed into an International Standard.

Attention is drawn to the possibility that some of the elements of this part of ISO <ISO standard number> may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

[end required]

Add the following text to an ISO Technical Specification

[ISO required]

ISO/TS <ISO standard number>-<part number> was prepared by Technical Committee ISO/TC184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data*.

[end required]

Add the following text for an ISO Publicly Available Specification.

[SC4 required]

ISO/PAS <ISO standard number>-<part number> was prepared by Technical Committee ISO/TC184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data*.

[end required]

NOTE Further guidance will be sought from the ISO Central Secretariat regarding any requirements for boilerplate text to be included in the foreword of a PAS or TS that is published for a second three- year period.

The remaining text of the foreword follows the same pattern as that for International Standards:

[ISO 10303 required]

This International Standard is organized as a series of parts, each published separately. The structure of this International Standard is described in ISO 10303-1.

Each part of this International Standard is a member of one of the following series: description methods, implementation methods, conformance testing methodology and framework, integrated generic resources, integrated application resources, application protocols, abstract test suites, application interpreted constructs, and application modules. This part is a member of the <provide series name> series.

[end required]

Then introduce the URL that references the complete list of parts of ISO 10303 (generated from the SC4 database and held on SOLIS), using the following text.

[ISO 10303 required]

A complete list of parts of ISO 10303 is available from the Internet:

`<http://www.nist.gov/sc4/editing/step/titles/>`

[end required]

Other SC4 standards shall include similar text to describe their structure and reference a list of parts. Projects should consult the SC4 Secretariat and the Quality Committee to determine the URL to be used to reference the list of parts.

The last paragraph of the foreword lists the annexes found in the document.

Use the appropriate choice from the following wording, expanding the number of annexes as required:

[ISO required]

Annex(es) <list of normative annex(es)> form(s) a normative part of this part of ISO <ISO standard number>. Annex(es) <list of informative annex(es)> is (are) for information only.

[end required]

If there are no annexes of either type, do not include the corresponding sentence.

See ISO/IEC Directives, Part 3, 6.3.8 and 6.4.1 for explanations of annexes. See 4.2.7 and 4.3.1 for general requirements that apply to annexes of all SC4 standards. See 7.5, 8.5, and 9.9 for requirements that apply to parts in the integrated resources, application interpreted constructs, and application protocols series of ISO 10303.

NOTE An example page showing the layout and content of the foreword of a part of ISO 10303 that is to be published as a Technical Specification is included in annex C.

4.1.5 Introduction

Each SC4 standard shall contain an introduction stating what the subject is (definition), why the subject is important (usefulness), and what to look for (key points) in the standard, and a summary of the background knowledge needed to understand the standard. The introduction may include additional explanatory material such as a description of the target audience for the standard or a statement of typographical conventions used in the document. The introduction may include references to other documents that may be useful to the reader of the standard.

The introduction shall not contain requirements but may contain figures, tables, notes, examples, and footnotes. If the introduction describes the scope, use the same wording as the scope clause.

The introduction shall not be numbered unless there is a need to create numbered subdivisions. In this case, it shall be numbered 0 with subclauses being numbered 0.1, 0.2, ...

NOTE Such subdivision of the introduction can be used to separate different aspects such as an overview of the part, a description of the target audience, and a description of the conventions used in the part.

4.1.5.1 Wording for the introduction of parts of ISO 10303

NOTE This subclause is specific to ISO 10303. Other SC4 standards should take a similar approach to documentation of the introduction.

4.1.5.1.1 Integrated resources series

Use the following text at the start of the introduction of each part of ISO 10303 that is a member of the integrated resources series:

[ISO 10303 required]

ISO 10303 is an International Standard for the computer-interpretable representation of product information and for the exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving.

[end required]

For the parts with more than one schema, use the following:

[ISO 10303 required]

This part of ISO 10303 is a member of the integrated resources series. Major subdivisions of this part of ISO 10303 are: <use list format to list the names of the schemas, or descriptions of groups of schemas>.

[end required]

For the parts with only one schema, use the following:

[ISO 10303 required]

This part of ISO 10303 is a member of the integrated resources series. This part of ISO 10303 specifies the <schema name>.

[end required]

This may be followed by one or more paragraphs that provide an overview of the schema or schemas, without stating requirements. If information from the scope clause is repeated, use the same wording as in the scope.

In an integrated resources part, include a schema level model that illustrates the schema(s) specified in the context of the integrated resources as a whole, introduced by the following wording:

[ISO 10303 required]

The relationships of the schemas in this part of ISO 10303 to other schemas that define the integrated resources of this International Standard are illustrated in Figure <figure number> using the EXPRESS-G notation. EXPRESS-G is defined in annex D of ISO 10303-11. The <list schemas from other parts depicted in the diagram> are specified in <list the parts>. The schemas illustrated in Figure <figure number> are components of the integrated resources.

[end required]

4.1.5.1.2 Application interpreted construct series

Use the following text at the start of the introduction of each part of ISO 10303 that is a member of the application interpreted construct series:

[ISO 10303 required]

ISO 10303 is an International Standard for the computer-interpretable representation of product information and for the exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving.

This part of ISO 10303 is a member of the application interpreted construct series. An application interpreted construct (AIC) provides a logical grouping of interpreted constructs that supports a specific functionality for the usage of product data across multiple application contexts. An interpreted construct is a common interpretation of the integrated resources that supports shared information requirements among application protocols.

This document specifies the application interpreted construct for <insert a phrase describing the AIC's functionality>.

[end required]

Additional sentences may be included as necessary to describe the functionality of the AIC.

EXAMPLE The following is an example of the last required sentence of the introduction of an application interpreted construct: "This document specifies the application interpreted construct for the description of a geometric shape by means of manifold surface."

4.1.5.1.3 Application protocol series

Use the following text at the start of the introduction of each part of ISO 10303 that is a member of the application protocol series:

[ISO 10303 required]

ISO 10303 is an International Standard for the computer-interpretable representation of product information and for the exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving.

This part of ISO 10303 is a member of the application protocol series. This part of ISO 10303 specifies an application protocol (AP) for <insert description of the overall purpose of the AP>.

This application protocol defines the context, scope, and information requirements for <insert phrase summarizing AP purposes> and specifies the integrated resources necessary to satisfy these requirements.

Application protocols provide the basis for developing implementations of ISO 10303 and abstract test suites for the conformance testing of AP implementations.

Clause 1 defines the scope of the application protocol and summarizes the functionality and data covered by the AP. Clause 3 lists the words defined in this part of ISO 10303 and gives pointers to words defined elsewhere. An application activity model that is the basis for the definition of the scope is provided in annex F. The information requirements of the application are specified in clause 4 using terminology appropriate to the application. A graphical representation of the information requirements, referred to as the application reference model, is given in annex G.

Resource constructs are interpreted to meet the information requirements. This interpretation produces the application interpreted model (AIM). This interpretation, given in 5.1, shows the correspondence between the information requirements and the AIM. The short listing of the AIM specifies the interface to the integrated resources and is given in 5.2. Note that the definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes which are not imported into the AIM. The expanded listing given in Annex A contains the complete EXPRESS for the AIM without annotation. A graphical representation of the AIM is given in annex H. Additional requirements for specific implementation methods are given in annex C.

[end required]

4.1.5.1.4 Abstract test suite series

Use the following text at the start of the introduction of each part of ISO 10303 that is a member of the abstract test suite series:

[ISO 10303 required]

ISO 10303 is an International Standard for the computer-interpretable representation of product information and for the exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving.

This part of ISO 10303 specifies the abstract test suite for ISO 10303-*< insert part number of corresponding application protocol >*, Application protocol: *<title of application protocol>*. The abstract test cases presented here are the basis for conformance testing of implementations of ISO 10303-*< insert part number of corresponding application protocol >*.

The purpose of an abstract test suite is to provide a basis for evaluating whether a particular implementation of an application protocol actually conforms to the requirements of that application protocol. A standard abstract test suite helps ensure that evaluations of conformance are conducted in a consistent manner by different test laboratories.

This part of ISO 10303 specifies the abstract test suite for ISO 10303-*<part number>*, application protocol *<part title>*. The abstract test cases presented here are the basis for conformance testing of implementations of ISO 10303-*<part number>*.

This abstract test suite is made up of two major parts:

- the test purposes, the specific items to be covered by conformance testing;
- the set of abstract test cases that meet those test purposes.

The test purposes are statements of the application protocol requirements that are to be addressed by the abstract test cases. Test purposes are derived primarily from the application protocol's information requirements and AIM, as well as from other sources such as standards referenced by the application protocol and other requirements stated in the application protocol conformance requirements clause.

The abstract test cases address the test purposes by:

- specifying the requirements for input data to be used when testing an implementation of the application protocol;
- specifying the verdict criteria to be used when evaluating whether the implementation successfully converted the input data to a different form.

The abstract test cases set the requirements for the executable test cases that are required to actually conduct a conformance test. Executable test cases contain the scripts, detailed values, and other explicit information required to conduct a conformance test on a specific implementation of the application protocol.

At the time of publication of this document, conformance testing requirements had been established for implementations of application protocols in combination with ISO 10303-21 and ISO 10303-22. This part of ISO 10303 only specifies test purposes and abstract test cases for a subset of such implementations.

For ISO 10303-21, two kinds of implementations, preprocessors and postprocessors, must be tested. Both of these are addressed in this abstract test suite.

For ISO 10303-22, a class of applications will possess the capability to upload and download AP-compliant SDAI-models or schema instances to and from applications that implement the SDAI. By providing test case data that correspond with SDAI-models, this abstract test suite addresses such applications in a single-schema scenario.

[end required]

4.1.5.1.5 Application modules series

Use the following text at the start of the introduction of each part of ISO 10303 that is a member of the application modules series:

[ISO 10303 required]

ISO 10303 is an International Standard for the computer-interpretable representation of product information and for the exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving.

This part of ISO 10303 specifies an application module for <insert text summarizing the purpose and content of the module>.

[end required]

NOTE This text is based on that found in the Committee Drafts of parts 1001-1009, and is subject to change when the relevant modularization guidelines documents are submitted for review and approval.

4.1.5.1.6 Other parts

For other parts of ISO 10303 (excluding ISO 10303-1), use the following:

[ISO 10303 required]

ISO 10303 is an International Standard for the computer-interpretable representation of product information and for the exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving.

This part of ISO 10303 is a member of the <insert series name> series. This part of ISO 10303 specifies <insert description of the part>.

[end required]

4.1.5.1.7 Second edition parts

For second editions, provide a list of the significant technical changes from the previous edition. For the second editions, which are intended to be upwardly compatible with the “initial release” editions, preface this list by the following text:

[ISO 10303 required]

This edition incorporates modifications that are upwardly compatible with the previous edition. Modifications to EXPRESS specifications are upwardly compatible if:

- instances encoded according to ISO 10303-21, and that conform to an ISO 10303 application protocol based on the previous edition of this part, also conform to a revision of that application protocol based on this edition;
- interfaces that conform to ISO 10303-22 and to an ISO 10303 application protocol based on the previous edition of this part, also conform to a revision of that application protocol based on this edition;
- the mapping tables of ISO 10303 application protocols based on the previous edition of this part remain valid in a revision of that application protocol based on this edition.

[end required]

4.2 Normative elements

Normative elements are divided into two types: general and technical (see Table 1). General normative elements are the title (see 4.2.2), the scope clause (see 4.2.3), and the normative references clause (see 4.2.4). Technical normative elements are the terms and definitions clause (see 4.2.5), clauses specifying requirements (see 4.2.6), and normative annexes (see 4.2.7).

4.2.1 Clauses and subclauses

The main body of text of an International Standard is documented in a series of clauses and subclauses. A clause is the basic component of the subdivision of text of an International Standard. A subclause is a numbered subdivision of a clause while a subsubclause is a numbered subdivision of a subclause. Clauses may be subdivided as far as the fifth level of subclause (such as 5.1.1.1.1.1). See also ISO/IEC Directives, Part 3, 5.1 and 5.2.

NOTE In this standing document, the term “subclause” is used to refer to any subdivision of a clause or annex, independent of its level. For example 4.1 and 4.1.1.3 are both referred to as “subclauses”.

“Legal style” shall be used for numbering of subclauses. Legal style is as follows:

- Subdivisions of a clause or subclause shall be sequentially numbered with Arabic numbers beginning with 1.

NOTE This means that there can never be subclauses with numbers such as “1.0” and “2.0”.

- This number shall be preceded by the number of the clause or subclause of which it is a subdivision.
- The number of the subdivision shall be separated from the number of the clause or subclause of which it is a subdivision by a period.
- The number of a subdivision shall not be followed by a period.

NOTE The clause and subclause numbering in this standing document follow the legal style of numbering.

4.2.2 Title

The title is a two-part element. The introductory part of the element indicates the general field in which the International Standard belongs and the main part of the element indicates the specific subject being addressed within that general field.

For parts of ISO 10303, the title shall be:

[ISO 10303 required]

Industrial automation systems and integration — Product data representation and exchange — Part <part number>: <part title>.

[end required]

For parts of ISO 13584, the title shall be:

[ISO 13584 required]

Industrial automation systems and integration — Parts library — Part <part number>: <part title>.

[end required]

For parts of ISO 15531, the title shall be:

[ISO 15531 required]

Industrial automation systems and integration — Manufacturing management data — Part <part number>: <part title>.

[end required]

For parts of ISO 15926, the title shall be:

[ISO 15926 required]

Industrial automation systems and integration — Integration of life-cycle data for process plants including oil and gas production facilities — Part <part number>: <part title>.

[end required]

For parts of ISO 18629, the title shall be:

[ISO 18629 required]

Industrial automation systems and integration — Process specification language — Part <part number>: <part title>.

[end required]

For parts of ISO 18876, the title shall be:

[ISO 18876 required]

Industrial automation systems and integration — Integration of industrial data for exchange, access, and sharing — Part <part number>: <part title>.

[end required]

4.2.3 Scope

The scope clause is intended to communicate the area of applicability of the standard. The scope clause shall include statements of fact that define the subject of the standard, the aspects covered, and optionally, those that are not. The scope may be defined using list format (preferred) or narrative text. If there is only one item within scope, list format shall not be used. If using the list format, all in-scope items shall be given followed by all out-of-scope items.

The scope clause shall begin immediately after the title element (see 4.2.2). Its clause number shall be “1”.

The scope clause shall start with the following wording:

[ISO required]

This part of ISO <ISO standard number> specifies ...

[end required]

In most cases, this clause should continue as follows, using a list format to give a sequence of subject areas:

[ISO required]

This part of ISO <ISO standard number> specifies the following:

[end required]

Use the following wording to introduce any further information that is within the scope of the part but does not fit into the first list.

[ISO required]

The following is (are) within the scope of this part of ISO <ISO standard number>:

[end required]

Use the following wording to introduce information that is outside the scope of the part.

[ISO required]

The following is (are) outside the scope of this part of ISO <ISO standard number>:

[end required]

The scope shall not contain requirements.

NOTE Scope clauses are typically between one and three pages long.

4.2.4 Normative references

The normative references clause specifies the normative documents, their titles, and publication dates that are referenced in the text in such a way as to make any part of the referenced document required for the application of the referencing standard.

If there are two or more normative references, use the following paragraph at the start of the normative references clause:

[ISO required]

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO <ISO standard number>. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO <ISO standard number> are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

[end required]

If there is only one normative reference, use the following paragraph at the start of the normative references clause:

[ISO required]

The following normative document contains provisions which, through reference in this text, constitute provisions of this part of <ISO standard number>. For a dated reference, subsequent amendments to, or revisions of, this publication do not apply. However, parties to agreements based on this part of <ISO standard number> are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For an undated reference, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.”

[end required]

This wording shall be followed by a list of normative references, in the following order:

- IEC standards, ordered by their standard number;
- ISO standards, ordered by their standard number;
- other standards, ordered alphabetically by their standard designation and standard number.

4.2.4.1 Normative references to International Standards

Each normative reference shall include the following information:

- the standard reference number, including its date of publication;
- the full title of the standard.

EXAMPLE 1 The following example illustrates a normative reference to ISO 10303-1:

ISO 10303-1:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles*.

Requirements for the format and layout of normative references are specified in 5.4.5.

NOTE 1 As in the above example, an exception to the rule that examples shall appear in 10 point type has been made in various places throughout this standing document so that editors can see exactly how the information being presented should appear. Examples that show specific formats or layouts to be used in SC4 standards are distinguished from other text by a light grey background.

For documents that are being prepared for DIS ballot, FDIS ballot, IS publication, or TS publication each international standard (ISO and/or IEC) that is listed in clause 2 shall be at DIS status or higher.

NOTE 2 At the DIS level, it is permitted for one DIS document to reference another document that is not yet registered/published as DIS, as long as there is a reasonable expectation that the referenced document will be registered before or at the same time as the referencing document. If there is a doubt over this, the project leader or part editor should consult with the applicable working group convener(s) and/or the SC4 Secretariat before finalizing the referencing part for ballot.

Working drafts and Committee Drafts may include references to standards that are themselves at working draft or Committee Draft status.

For a normative reference to a standard that has not been published, replace the year of publication by a long dash together with a footnote “To be published.”.

The following shall not be used as normative references:

- documents that are not publicly available;
- documents to which only informative reference is made;
- documents that have served as references in preparing the standard.

List these documents in the bibliography, which is informative.

All parts of ISO 10303 shall include ISO 10303-1 and ISO/IEC 8824-1 in the list of normative references. All implementation methods, integrated resources, application protocols, and application interpreted constructs shall also include a reference to ISO 10303-11. The full reference for ISO/IEC 8824-1 is:

[ISO 10303 required]

ISO/IEC 8824-1:1995, *Information Technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation*.

[end required]

NOTE 2 Not all published standards follow the requirement of the ISO/IEC Directives, Part 3 that only the first word of each title element is capitalized. Editors should check titles of standards listed in the normative reference clause in the ISO and IEC catalogues which are available from the Internet:

<<http://www.iso.ch>>

<<http://www.iec.ch>>

4.2.4.2 Normative references to technical specifications, publicly available specifications, and technical reports

ISO technical specifications, publicly available specifications, and technical reports may be included as normative references. These are denoted in the reference by “ISO/TS”, “ISO/PAS”, and “ISO/TR” in respectively.

EXAMPLE 1 The following is an example of a normative reference to an ISO Technical Specification:

ISO/TS 10303-304:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 304: Abstract test suite: Mechanical design using boundary representation.*

EXAMPLE 2 The following is an example of a normative reference to an ISO Publicly Available Specification:

ISO/PAS 19999:2001, *Reference model for systems engineering.*

EXAMPLE 3 The following is an example of a normative reference to ISO Technical Report:

ISO/TR 10303-14:1997, *Industrial automation systems and engineering — Product data representation and exchange — Part 12: Description methods: The EXPRESS-I language reference model.*

NOTE This is a reference to an “old style” technical report that would under current procedures be published as a technical specification. Given that the designation “technical report” is now reserved for “data of a different kind from that which is normally published as an International Standard” it is unlikely that new technical reports will be used as normative references.

4.2.4.3 Normative references to second (and subsequent) edition parts

If a part includes a normative reference to the second (or subsequent) edition of another part, the following requirements apply.

If the referenced part has been published by ISO (that is, an IS document is listed in the ISO catalogue and is available for purchase), follow the directions provided in 4.2.4 and in clause 6.2.2 of the ISO/IEC Directives, Part 3. Once a second or subsequent edition has been published, references to it are distinguished from previous editions only by the date of publication.

EXAMPLE 1 The following normative reference refers to the first edition of Part 43.

ISO 10303-43:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 43: Integrated generic resources: Representation structures.*

EXAMPLE 2 The following normative reference refers to the second edition of Part 43.

ISO 10303-43:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 43: Integrated generic resource: Representation structures.*

NOTE 1 In this example, there is a minor variation between the titles of the first and second editions. In most cases, this variation will not occur.

If the referenced part has not yet been published, the direction provided in 4.2.4 applies with the following exception. In the footnote that states that the referenced part is to be published, add a qualifier stating the document reference of the previous edition in parentheses. Use the following example as a model.

EXAMPLE 3 The following normative reference refers to the second edition of ISO 10303-41 (not yet published at the time of writing this document).

ISO 10303-41:—¹⁾, *Industrial automation systems and integration — Product data representation and exchange — Part 41: Integrated generic resource: Fundamentals of product description and support.*

¹⁾ To be published. (Revision of ISO 10303-41:1994)

NOTE 2 The footnote forms part of this example and should, of course, appear at the bottom of the page on which the reference to the unpublished standard appears.

There can be several different “to be published” footnotes:

- one without any qualification for all referenced first editions that have not been published;
- one with qualification for each referenced second or subsequent edition that has not yet been published.

4.2.4.4 Normative references to amendments

Because normative references in ISO 10303 parts are normally dated, amendments to the referenced standards are not included in such a reference (unlike Technical Corrigenda).

EXAMPLE 1 The following reference includes the published Technical Corrigenda to Part 21, but not any amendment(s).

ISO 10303-21:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 21: Description methods: Clear text encoding of the exchange structure.*

NOTE The nature of the Technical Corrigenda published for some ISO 10303 parts means that it may be essential that an implementation of one part depends on the Technical Corrigenda to another. There is no way of stating this dependency in the normative reference (which automatically includes all TCs). However, readers’ and implementer’s attention can be drawn to this dependency through suitable NOTES in the referencing standard. In the case of Application Protocols that depend on TCs in one or more Integrated Resources, such NOTES can be included adjacent to the USE FROM EXPRESS language statements in clause 5.2 (AIM short form). It may also be useful to include an equivalent comment in the accompanying EXPRESS long form.

If a part of ISO 10303 needs to reference an amended standard, specify the applicable amendments(s) in the normative reference.

EXAMPLE 2 The following example specifies that the published amendment to ISO 10303-21 is part of the normative reference:

ISO 10303-21:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 21: Description methods: Clear text encoding of the exchange structure and its Amendment 1: 2001.*

NOTE The phrase “and its Amendment ...” is not in italics.

An amendment can have a title that is different from the amended standard; if this is the case, include the title of the amendment (in italics) after the year of publication, separated by a comma.

4.2.4.5 Normative references to national standards, regional standards, and other specifications

References to other types of standards or specifications should follow the requirements specified in 4.2.4.1, taking into account the conventions for identifying and naming documents used by the publishing organization.

4.2.5 Terms and definitions

The terms and definitions clause is normative, but shall not contain requirements.

Each definition shall take the form of a noun clause in which the term being defined should not appear. The first word of the noun clause shall be in lower case unless it is a proper noun. The noun clause may be followed by one or more sentences if necessary. Notes may be used but such cases should be the exception. See also ISO 10241:1992 and annex C of the ISO/IEC Directives, Part 3. A guide for writing definitions is provided in annex B of this document.

The clause heading for terms and definitions shall be one of the following:

- If clause 3 only contains terms and definitions, the title of the clause shall be “Terms and definitions”.
- If clause 3 only contains terms, definitions, and abbreviations, the title of the clause shall be “Terms, definitions, and abbreviations”.
- If clause 3 only contains terms, definitions, and symbols, the title of the clause shall be “Terms, definitions, and symbols”.
- If clause 3 contains terms, definitions, abbreviations, and symbols, the title of the clause shall be “Terms, definitions, abbreviations, and symbols”.

The clause title shall use plural wording even if the list consists of only one item.

4.2.5.1 General requirements for definitions

Each definition that is specified in a standard consists of the following:

- the term being defined;
- one or more synonyms for the term (optional);
- an abbreviation for the term (optional);
- the definition of the term.

If a term has an abbreviation, the term being defined shall be given in full and shall be followed by its abbreviation in parentheses, using the following format:

[ISO required]

3.x.y

<term> <abbreviation for term, in parentheses>

<definition>

[end required]

NOTE This is the only case in any ISO standard where the subclause number and the subclause title are placed on different lines.

The abbreviation shall also appear in the abbreviations subclause. Definitions shall not end with a period. The terms defined in this subclause shall not appear in the table of contents. The terms defined in this subclause shall be listed in the index.

For definitions that have been extracted from another document that is not a standard, or have been modified from a definition that appears in another standard, the definition shall be followed by a note. This note shall have the following form: “Adapted from <reference to the document> [n]”, where [n] is a reference to the bibliography (see 4.4.2).

For terms that have commonly used synonyms, the synonyms shall be listed after the term’s definition. Each synonym shall be separated from its predecessor by a semicolon, using the following format:

[ISO required]

3.x.y

<term>; <synonym>

<definition>

[end required]

4.2.5.2 Requirements for ISO 10303

In each part of ISO 10303, terms that are defined in other standards shall be listed in separate subclauses, as described below. The order of these subclauses shall be as follows:

- definitions from IEC standards, ordered by their standard number;
- definitions from other ISO standards, ordered by their standard number;
- definitions from other standards, ordered alphabetically by their standard designation and standard number.

In general, the terms and definitions clause of each part of ISO 10303 will contain at least two subclauses: terms defined in ISO 10303-1, and terms defined in the part of ISO 10303 being written. Certain parts of ISO 10303 may find it necessary to refer to definitions in other parts of ISO 10303 or in other International Standards. For the terms that are defined in other documents use the following text as a model for the subclause. Include a subclause titled “Terms defined in ISO 10303-1” with the following wording:

[ISO 10303 required]

For the purpose of this part of ISO 10303, the following terms defined in ISO 10303-1 apply.

[end required]

This is followed by a list (see 4.5) of the terms in alphabetical order without their definitions. This same form may be used for terms defined in others parts of ISO 10303 or in other standards. The part of ISO 10303 or other standard so referenced shall be included in the normative reference clause.

Particular attention should be paid to the list of definitions in ISO 10303-1. If any terms defined there are used in the document, they shall be included in this list.

A separate subclause of this form shall be used for each document from which definitions are drawn. These subclauses shall be followed by a subclause with the definitions of the terms defined in this part of ISO 10303. The title of this subclause shall be “Other terms and definitions” with the following wording:

[ISO 10303 required]

For the purposes of this part of ISO 10303, the following definitions apply:

[end required]

The wording shall be followed by a series of numbered subclauses in alphabetical order of the terms being defined.

4.2.5.3 Requirements for other SC4 standards

SC4 standards apart from ISO 10303 may either follow the requirements described in 4.2.5.2 or may use an alternative form of definitions as described in this subclause. All terms (independent of source) may be listed alphabetically in a single clause, with indication of the source of the definition. The text of definitions from other standards may be repeated.

If this format for terms and definitions is used, use introductory wording of the form:

[ISO required]

For the purposes of this part of ISO <ISO standard number>, the following terms and definitions apply. Terms defined in <list normative references for included definitions> are repeated below for convenience.

NOTE Definitions copied verbatim from other standards are followed by a reference to the source standard in brackets. Definitions that have been adapted from other standards are followed by an explanatory note.

[end required]

(The second sentence of this NOTE is applicable only if there are any definitions that come from another standard but whose wording has been modified for the purposes of the part).

Then present all the terms and their definitions using the format:

[ISO required]

3.x

<term>

<definition>

[end required]

NOTE If clause 3 only contains terms and definitions, each definition will be numbered 3.x. If clause 3 also contains abbreviations or symbols, it will be divided into at least two subclauses; all definitions will be listed in a subclause titled “Terms and definitions” and each definition will be numbered 3.x.y.

EXAMPLE A definition imported from Part 1 of STEP is shown below:

3.x**product information**

facts, concepts, or instructions about a product

[ISO 10303-1]

Any standard referenced as the source of a definition shall be listed in the normative references clause.

Present any terms and their definitions whose wording has been altered using the format:

[ISO 10303 required]

3.x

<term>

<definition>

[end required]

NOTE Adapted from ISO sssss-ppp

EXAMPLE A definition that has been reworded from another standard is shown below.

3.y**data**

representation of information in a formalized manner suitable for communication, interpretation, or processing by human beings or computers

NOTE Adapted from ISO/IEC 2382-1.

Any standard referenced like this should be listed in the Bibliography, unless it is also referenced normatively elsewhere, in which case it is listed in clause 2 anyway.

4.2.5.4 Symbols and abbreviations

A symbols and abbreviation subclause is an optional element that lists the symbols and abbreviations necessary for the understanding of the standard. This element may be combined with the previous element if both elements are short. If combined, the title of the clause shall be “Definitions, symbols, and abbreviations”, “Definitions and symbols”, or “Definitions and abbreviations”, as appropriate.

Alternatively, a separate subclause with the title “Symbols” may be used for symbols, and a separate subclause with the title “Abbreviations” may be used for abbreviations.

Use the following wording to introduce this element:

[ISO required]

For the purposes of this part of ISO <ISO standard number>, the following symbols and abbreviations apply:

[end required]

NOTE If either symbols or abbreviations are not present, remove the corresponding words from the required wording.

The symbols and abbreviations shall be given in two left-justified, unbolded columns without punctuation (except as part of the abbreviated term or the explanation of the symbol). Capitalization shall correspond to the use of the abbreviation. Align the left column with the left margin. The right column shall contain the phrase corresponding to the symbol or abbreviation. See 3.5 for an example of an abbreviations subclause.

The following abbreviations may be used in the text without definition; do not list these abbreviations in this clause:

- ISO;
- IEC.

4.2.6 Clauses specifying requirements

Each standard may contain clauses that specify those provisions that shall be satisfied to claim compliance with the standard.

NOTE The only standards that do not contain at least one clause specifying requirements are those that specify terminology.

The following types of provisions constitute requirements:

- all characteristics relevant to the aspect(s) of the product(s), process(es) or service(s) covered by the standard, either explicitly or by reference;
- the required limiting values of quantifiable characteristics;
- either a reference to the test method for determining or verifying the values of the characteristic or the test method itself for each requirement. (This is a requirement specified in the ISO/IEC Directives Part 3 and may not apply to parts of SC4 standards.)

In SC4 standards, clauses that specify requirements include the following:

- specification of the syntax and semantics of a modelling language;
- specification of the characteristics of an implementation method;
- specification of a data specification;
- specification of conformance requirements.

There shall not be a clause in any part of an SC4 standard titled “Requirements”. See clause 6 for requirements that apply to clauses that define an EXPRESS schema. See clauses 7, 8, 9, 10, and 11 for the titles and required content of clauses to be included in specific series of parts of ISO 10303.

4.2.7 Normative annexes

Normative annexes are essential parts of an International Standard and are the last normative elements; they are placed after the last clause and before the informative annexes.

NOTE This ordering of annexes is an exception to the requirements of the ISO/IEC Directives Part 3, which state that annexes appear in the order in which they are cited in the text of the standard, independent of their normative or informative nature. The ISO Central Secretariat has agreed to the annex ordering specified here on the basis that a regular structure for annexes has been established for all ISO 10303 parts.

The fact that an annex is normative shall be made clear by a statement to this effect in the foreword, by an indication in the table of contents, and in the heading of the annex itself.

See 7.5.1, 8.5.1, and 9.9.1 for the normative annexes that are to be included in the integrated resources, application interpreted constructs, and application protocols series of parts of ISO 10303.

4.2.7.1 Numbering within annexes

Annexes shall be labelled “Annex A”, “Annex B”, and so on. Subdivisions of an annex shall be labelled in the same way as subclauses (see 4.2.1), substituting the letter that identifies that annex for the clause number.

EXAMPLE Subdivisions of annex A are labelled A.1 and A.2. Subdivisions of A.1 are labelled A.1.1 and A.1.2.

NOTE Subdivisions of annexes are not included in the table of contents (see 4.1.3).

4.2.7.2 Information object registration annex

All parts of ISO 10303 shall have at least one normative annex. This annex defines the information object identifier for the part as specified by ISO/IEC 8824-1 and shall be the final normative annex in each part. See annex B for the requirements that apply to this annex of a part of ISO 10303.

4.2.7.3 References to annexes in the table of contents

All annexes are referenced in the table of contents of the document. In the table of contents, the annex reference is left justified. The first word of the table of contents entry shall be “Annex” followed by a space and a capital letter designating the serial order of the annex, followed by a space and the text “(normative)” or “(informative)” (see 4.3.2.4.2), followed by a space and the title of the annex.

4.3 Supplementary Elements

Supplementary elements provide information to assist in understanding a standard. These elements shall not contain requirements.

4.3.1 Informative annexes

Informative annexes give additional information and are placed after the normative elements of a standard. They shall not contain requirements. The fact that an annex is informative shall be made clear by a statement to this effect in the foreword and by an indication in the heading of the annex itself. The format for the heading for informative annexes is given in 5.3.6.

See clauses 7-11 for informative annexes that may be included in the various series of parts of ISO 10303.

4.3.2 Bibliography

4.3.2.1 Structure and content of the bibliography

The bibliography is an optional element of the standard; if included, it shall appear after the last annex and before the index. The bibliography shall contain a list of reference documents that further explain the concepts contained in the part or constitute “further reading”. Entries in the bibliography shall be numbered using Arabic numbers enclosed in brackets. The format for bibliography entries is as follows:

- Author's family name followed by a comma, and the author's initials or given name(s). The family name shall be in upper case. If included, the author's initials shall be in upper case. If included, the author's given name(s) shall be in title case. If there are more than three authors, list two or three and follow with "et al.". The list of authors is followed by a period; if there are two or more authors, their names are separated by semicolons.
- Title of publication in italics, followed by a comma.
- Subordinate responsibility (such as "edited by ..."), followed by a comma.
- Edition, followed by a comma.
- Publication (place and publisher separated by a colon), followed by a comma.
- Standard number, if applicable.

To use a part of ISO 10303 or another International Standard as an entry in the bibliography, use the same format as that presented in 4.3.1.3. However, precede each entry with a number as explained in the first paragraph of this subclause. For further information on how to reference information in a bibliography, refer to ISO 690.

Entries in the bibliography shall appear in the following order:

- IEC standards;
- ISO standards;
- other standards, ordered alphabetically by their standard designation;
- books or documents with a known author ordered by the surname of the (first) author;
- books or documents without a known author are listed by the first word of the title (ignoring any initial definite or indefinite article).

EXAMPLE 1 The following is an example of a bibliography showing all the possible types of entry and their required order.

- | | |
|-----|--|
| [1] | IEC 60079-1 (2001-02) Ed. 4.0, <i>Electrical apparatus for explosive gas atmospheres — Part 1: Flameproof enclosures "d"</i> . |
| [2] | ISO 9000:2000, <i>Quality management systems — Fundamentals and vocabulary</i> . |
| [3] | ISO/IEC 11179-6:1997, <i>Information technology — Specification and standardization of data elements — Part 6: Registration of data elements</i> . |
| [4] | ANS US PRO/IPO-100-1993. IGES 5.2, <i>Initial Graphics Exchange Specification</i> , Nov. 1993. |
| [5] | BS 308-2:1985, <i>Engineering drawing practice. Recommendations for dimensioning and tolerancing of size</i> . |
| [6] | DODGSON, Charles L.: [Lewis Carroll]. <i>Alice's Adventures In Wonderland</i> . New York: D. Appleton and Co., 1866. |
| [7] | O'BRIEN, Flann. <i>The Third Policeman</i> , London: Flamingo, 1993. |

- [8] *Guidelines for the development and approval of STEP application protocols*, ISO TC184/SC4 N535, 1998-12-18.
- [9] *SC4 Quality Manual*, ISO TC184/SC4 N1110, 2000-11-08 [cited 2001-03-22]. Available from the World Wide Web: <http://www.nist.gov/sc4/howto/qual_man/current/sc4n1110.htm>.

NOTE The last entry in this example illustrates a reference to a document that is available via the Internet, using the format prescribed by ISO 690-2. The phrase “[cited 2001-03-22]” states that the URL quoted was valid on that date.

4.3.2.2 References to documents listed in the bibliography

References to the bibliography from the text of an SC4 standard shall be from informative content (foreword, introduction, note, example, or informative annex). A reference to an item in the bibliography consists of a short textual reference to the document (such as the name of the author(s), or the number of a standard), followed by the serial number of the referenced document as it appears in the bibliography. Enclose the serial number in brackets. An example for wording that may be used to prepare that note follows.

EXAMPLE 1 The following example refers to an entry in the bibliography of this standing document:

See the Concise Oxford Dictionary [11], Appendix XIII for a style guide on the use of punctuation.

EXAMPLE 2 This example is taken from a standard that makes reference to ISO 10303-41 informatively but does not make any other normative reference to it. In this example ISO 10303-41 is the third item in the referenced bibliography. The following text illustrates a reference to a standard in a bibliography:

The **product_definition** entity data type is defined in ISO 10303-41 [3].

4.3.3 Index

An index, the final element of a standard, is an alphabetical list of the terms defined in the main text and the major topics discussed in the main text.

NOTE 1 The index is not an annex. It is an additional informative element that is the last element in the standard.

The index shall include an entry for each term that is defined in clause 3 of the document (see 4.2.4.5). It cites the page where each definition or topic can be found and allows readers to find information quickly and easily. The integrated resources, application interpreted construct, and application protocol series of ISO 10303 have specific requirements for the index (see 7.7, 8.6, and 9.10 respectively). The index shall not contain EXPRESS attribute names. . Where there is a good case, other terms that readers of the document would need to find in the index, may be included.

The key to compiling a good index is selectivity. Instead of listing every possible reference to a term or a topic, select references to the formal definition of the term or to the clause, subclause, or paragraph where the topic is discussed fully or where a significant point is made about it. For actual index entries chose words or phrases that best represent a topic. Key terms are those that a reader would most likely look for in an index.

NOTE 2 See ISO 999 [1] and Alred, et al [4] for further information about creating an index.

4.4 Figures, tables, notes, examples, and footnotes

Tables, figures, notes, examples, and footnotes may be used to further explain the technical content of SC4 standards. All notes and examples are informative by definition.

4.4.1 Figures

Figures are normative if referenced from the main text and informative if referenced only from a note, example, or informative annex. Figures shall include a title and identification number and may include a legend, if necessary.

4.4.1.1 Numbering figures

Figures shall be numbered with Arabic numbers beginning with 1. Except for annexes, the numbering is independent of the numbering of the clauses, subclauses, and tables. Numbers of figures in annexes shall be preceded by the letter assigned to the annex and a period. The first figure in annex A would be referred to as “Figure A.1”.

4.4.1.2 Capitalizing figure titles

The first word in the title of all figures shall be capitalized. All other words in the title shall be in lower case unless they are proper names.

4.4.1.3 References to figures

References to figures shall be included in the text before the appearance of figures. The following are examples of wording that can be used to reference figures.

— shown in Figure 3

— (see Figure 3)

The word “Figure” shall be capitalized.

If a figure is referenced solely from a note or example, the figure shall be considered a part of the note or example and thus, is informative. In this case, it is important that the figure follow the note.

4.4.2 Tables

Tables are normative if referenced from normative text (clause, subclause, or normative index) and informative if referenced only from a note, example, or informative annex. Tables shall include a title and an identification number and may include a legend, if necessary.

4.4.2.1 Numbering tables

Tables shall be numbered with Arabic numbers beginning with 1. Except for annexes, the numbering is independent of the numbering of clauses, subclauses, and figures. Numbers of tables in annexes shall be preceded by the letter assigned to the annex and a period. The first table in annex A would be referred to as “Table A.1”.

4.4.2.2 Capitalizing titles of tables

The first word in the title of all tables shall be capitalized. All other words in the titles shall be in lower case unless they are proper nouns.

4.4.2.3 Continuing tables

When a table must be continued on another page or pages, repeat the number of the table as follows. On the last page of the continuation of the table, use the wording “Table <n> (concluded)” as the table title. If the table spans three or more pages, use the wording “Table <n> (continued)” as the table title on all pages other than that on which the table starts and that on which the table finishes.

EXAMPLE The example below illustrates table titles to be used on the first, second, and last pages of a table that spans three pages.

Table 1 — <title of table>	
... first page of table ...	
Table 1 (continued)	
... second page of table ...	
Table 1 (concluded)	
... last page of table	

4.4.2.4 Capitalization of column headings within tables

The first word in the heading of each column of a table shall begin with a capital letter. All other words in the heading shall be in lower case unless they are proper nouns.

4.4.2.5 Repeat of column headings within a table

If a table must be continued on another page, the column headings shall be repeated on each page of the table.

4.4.2.6 Units in tables

If units are used in a column of a table, they shall be indicated underneath the headings.

EXAMPLE The example below illustrates the specification of units in a table.

Widget height (mm)	Maximum velocity (m/s)
10.0	1.5
20.0	0.9

4.4.2.7 References to tables

All tables shall be referenced in the text at least once. Choose from the following wording to reference a table:

- given in Table 1;
- (see Table 1).

The word “Table” shall be capitalized.

4.4.3 Notes

Notes may be used to give information that is essential to the reader understanding the document. Notes may refer to normative elements or normative references, although notes are informative (unless they are notes within a normative table or a figure). Notes may be part of any element except the cover page, the title, and footnotes.

4.4.3.1 Placement of notes

Notes shall be placed after the clause, subclause, or paragraph to which they refer.

4.4.3.2 Identification and numbering of notes

Each note shall be preceded by the title NOTE placed at the beginning of the first line of the text of the note.

If a clause or subclause contains more than one note each note shall be preceded by NOTE <n>. Notes shall be numbered consecutively starting a 1 within the clause or subclause. <n> is to be replaced by the number of the note. The text of each note shall follow the Arabic numeral.

4.4.3.3 Notes within tables and figures

Notes within tables and figures are treated differently from notes within the text. Notes within tables and figures may contain requirements only if the figure or table itself is normative. The notes shall be placed within the frame of the relevant table or immediately above the title of the relevant figure. A separate numbering sequence of Arabic numbers shall be used for the notes in each table and each figure. See ISO/IEC Directives Part 3, 6.6.4.8 and 6.6.5.6.

4.4.4 Examples

Examples may be used for further clarification of items such as style for mathematical notation, documentation, dates, or references. Examples are informative.

4.4.4.1 Placement of examples

Examples shall be placed after the clause, subclause, or paragraph to which they refer.

4.4.4.2 Identification and numbering of notes

Each example shall be preceded by the title EXAMPLE placed at the beginning of the first line of the text of the example.

If a clause or subclause contains more than one example each example shall be preceded by EXAMPLE <n>. Examples shall be numbered consecutively starting a 1 within the clause or subclause. <n> is to be replaced by the number of the example. The text of each example shall follow the Arabic numeral.

4.4.5 Footnotes

Footnotes may be used to give additional information; however, their use shall be kept to a minimum. They shall not contain requirements, but may reference other parts of ISO 10303 or documents that are informative.

4.4.5.1 Placement of footnotes

The text of the footnote shall be placed at the bottom of the page of the text to which it relates. The text of the footnote shall be separated from the main body of the document by a left-justified, solid line approximately 5 cm. (two inches) long. Text of footnotes shall appear above the page footer.

4.4.5.2 Format of footnotes

Footnotes are designated in text by a raised (superscripted) Arabic number followed by a right parenthesis. All footnotes shall be consecutively numbered throughout a part of ISO 10303 beginning with 1. The same raised (superscripted) Arabic number followed by a right parenthesis used for the footnote in the main body of the text shall be used to designate the footnote text. An example of such use may be found in clause 2 of this standing document.

4.5 Lists

Lists may be introduced by a sentence (see Example 1), a complete grammatical proposition followed by a colon (see Example 2), or by the first part of a proposition without a colon (see Example 3), completed by the items in the list. Each item in the list shall be of the same grammatical construction (that is, all sentences, all noun phrases, or all verb phrases), and shall be grammatically consistent with the text that introduces the list.

Each item in a list shall be preceded by a dash or a bullet or, if necessary for identification, by a lower-case letter followed by a parenthesis. If it is necessary to subdivide further an item in the latter type of list, Arabic numerals followed by a parenthesis shall be used (see Example 1).

EXAMPLE 1 The following example illustrates an unordered list that is introduced by a sentence.

The following basic principles shall apply to the drafting of definitions.

- The definition shall have the same grammatical form as the term:
 - to define a verb, a verbal phrase shall be used;
 - to define a singular noun, the singular shall be used.
- The preferred structure of a definition is a basic part stating the class to which the concept belongs, and another part enumerating the characteristics that distinguish the concept from other members of the class.
- The definition of a quantity shall be formulated in accordance with the provisions of ISO 31-0:1992, 2.2. This means that a derived quantity may be defined by means of other quantities only. No unit shall be used in the definition of a quantity.

EXAMPLE 2 The following example illustrates a list that is introduced by a complete grammatical proposition:

No switch is required for any of the following categories of apparatus:

- apparatus having a power consumption not exceeding 10 W under normal operating conditions;
- apparatus having a power consumption not exceeding 50 W, measured 2 min after the application of any of the fault conditions;
- apparatus intended for continuous operation.

EXAMPLE 3 The following example illustrates a list that is introduced by the first part of a proposition:

Vibrations in the apparatus may be caused by

- unbalance in the rotating elements,
- slight deformations in the frame,
- the rolling bearings, and
- aerodynamic loads.

See 5.3.1.4 for information about the required format and layout of lists.

4.6 References within the text

References within the text shall be in one of the following forms (see also ISO/IEC Directives, Part 3, 6.6.6).

4.6.1 References to this International Standard

The form “This International Standard...” shall be used only when the entire standard is being referenced; if one part of the standard is being referred to, use the following form:

- “this part of ISO <ISO standard number>” (reference to this part only);
- “ISO <ISO standard number>-<part number>” (reference to another part).

NOTE 1 The word “part” used by itself is used with specific domain meaning in SC4 standards. For example, in ISO 10303 “part” refers to a manufactured object or piece part. When referring to one of the documents of an ISO standard, the wording should be “part of ISO <ISO standard number>”.

NOTE 2 The new edition of the ISO/IEC Directives Part 2: Rules for the structure and drafting of International Standards (due to be published in March 2001, and superseding Part 3:1997) specifies that for documents published as Technical Specifications the wording “this Technical Specification” shall be substituted for “this International Standard” in all relevant boilerplate text. ISO CS have clarified this requirement as follows. The phrase “this International Standard” refers to all the parts of an International Standard, so that even though some parts of ISO 10303 (and other SC4 standards) may be published as Technical Specifications, the phrase “this Technical Specification” shall not be used. A reference to the TS part itself uses the form “this part of ISO 10303”. The phrase “this Technical Specification” may only be used in the following circumstances:

- to refer to a single part Technical Specification;
- to refer to the whole of a multi-part Technical Specification (a “standard” all of whose parts are published as Technical Specifications).

4.6.2 References to other International Standards and documents

Any publicly available document recognized by SC4 as having wide acceptance and authoritative status as well as being publicly available (see ISO/IEC Directives, Part 3, 6.2.2). This includes national and industry standards. When there is also an ISO standard, the ISO standard shall be used.

When referring to another International Standard from normative text, use “ISO” in the text followed by the reference number; only include the part number if applicable. Give the full title in the normative references clause. References to a particular element of another International Standard shall include the clause referred to as well as the reference number of the International Standard. ISO Techni-

cal Specifications, Publicly Available Specifications, and Technical Reports may be referenced in the same way.

If reference is made to a standard from informative text where that standard has not been given as a normative reference, the standard shall be listed in the bibliography.

4.6.3 References to subdivisions of the text

Use “clause” only to refer to an entire clause. Do not use the words “subclause” or “reference”. Use the following forms:

- in accordance with clause 3;
- according to 3.1;
- details as given in 3.1.1;
- (see 3.1.1);
- as described in 3.1.2;
- see annex B.

4.7 Punctuation of words in a series

When three or more words are grouped together in a series, a comma shall follow the word that appears before the conjunction that precedes the last word in the series.

EXAMPLE The following sentence is an example of this type of punctuation. “In the United States, dogwood, cherry, and redbud are three types of trees that bloom in the spring.” Using the comma after the word “cherry” and before the conjunction “and” is an example of this type of punctuation.

4.8 Acceptable wording

This subclause gives details on the wording to be used to explain requirements and recommendations.

4.8.1 Using “shall” and “shall not”

The verbal forms “shall” and “shall not” indicate requirements to be followed to conform to the standard and from which no deviation is permitted. The words “shall” and “shall not” shall be used in normative text and shall not be used in the introduction, foreword, notes, or examples, which are informative text.

“Shall” shall be used to denote the following:

- is to ...;
- is required to ...;
- it is required that ...;
- has to ...;
- only ... is permitted;

— it is necessary

“Shall not” shall be used to denote the following:

- it is not allowed (permitted, acceptable, permissible)...;
- is required to be not ...;
- is required that ... be not...;
- is not to be

Do not use “must” except to describe “unavoidable” situations. Do not use “may not” instead of “shall not” to express a prohibition.

NOTE To express a direct instruction, such as referring to steps to be taken in a test method, use the imperative. For instance, “Use the imperative”.

4.8.2 Using “must” and “must not”

The words “must” and “must not” shall be used only to convey external statutory regulations.

4.8.3 Using “should” and “should not”

The words “should” and “should not” shall be used to recommend a particularly suitable possibility or course of action without excluding others.

“Should” shall be used to denote the following:

- it is recommended that ...;
- ought to ...;

“Should not” shall be used to denote the following:

- it is recommended that ... not;
- ought not to

4.8.4 Use of “may” and “need not”

The words “may” and “need not” are used to indicate a course of action that is permissible within the limits of the standard.

“May” shall be used to denote the following:

- is permitted;
- is allowed;
- is permissible.

“Need not” shall be used to denote the following:

- it is not required that ...;

— no ... is required.

Do not use “can” instead of “may” in this context. Do not use “possible” or “impossible” in this context.

NOTE “May” refers to something that is permitted whereas “can” refers to something that is possible.

4.8.5 Use of “can” and “cannot”

The words “can” and “cannot” indicate possibility and capability.

“Can” shall be used to denote the following:

- to be able to;
- to be in a position to;
- there is a possibility of;
- it is possible to.

“Cannot” shall be used to denote the following:

- to be unable to ...;
- to be not in a position to ...;
- there is no possibility of ...;
- it is impossible to

NOTE “Can” refers to something that is possible whereas “may” refers to something that is permitted.

4.8.6 Use of “i.e.”, “e.g.”, and “etc.”

Do not use “i.e.” and “e.g.”. Instead, use “that is” and “for example”. If using “that is,” the list that follows shall be all inclusive whereas “for example,” shall only list some of the possibilities and shall only appear in a note or example. Likewise, do not use “etc.”. End the series prior to the “etc.” being certain to use a serial comma before the “and” (added if not already there). To state that the series is incomplete, use “such as” at the start of the series.

4.8.7 Use of quotation marks

Quotation marks shall be used to set off words or phrases that may confuse the reader if not marked.

Double quotation marks “ ” denote quoted text. Single quotation marks ‘ ’ denote particular text string values.

4.8.8 Spelling

The spelling of names of organizations and their abbreviations shall be as used by those organizations in English, French, or Russian. For the text portion of the part, The Concise Oxford Dictionary of Current English shall be used for spelling.

NOTE Spelling checkers associated with word processor programs rarely, even in the “British spelling” mode, conform to the required dictionary.

Note the correct spelling of the following:

- numbers from one to nine shall be spelled out in words;
- modelling, modelled, centre, colour, coordinate, faceted, litre, metre, millimetre, neighbour, organization;

and the preferred spelling of the following:

- instantiation.

4.9 Hyphenation

In general, hyphenation should be used to improve readability and appearance. Hyphenation shall follow The Concise Oxford English Dictionary of Current English. These special terms shall be hyphenated as follows:

- non-zero;
- two-dimensional, three-dimensional (may be abbreviated as “2D” or “3D”);
- B-rep (boundary representation shall be spelled out the first time it appears in the text, followed by the abbreviation in parentheses, that is, “(B-rep)”. The term “B-rep” shall be added to the list of abbreviations;
- X-axis, Y-axis, and Z-axis.

Abbreviations shall not be divided by a line break.

4.10 Words to avoid

Avoid the use of words that are corporate trademarks. If this is necessary, accompany the word by the trademark symbol “TM”.

EXAMPLE The title of ISO 10303-27 is “Product data representation and exchange: Implementation methods: JavaTM programming language binding to the standard data access interface with Internet/Intranet extensions”. Since the word “Java” in this context is a trademark, it is accompanied by the symbol “TM”.

Avoid the following words to provide editorial consistency. However, if a project cites another ISO standard, or broadly-accepted terminology for a given domain for a specific meaning of a prohibited term, the editor should follow the cited spelling:

- and/or: rather than use this form, expand the explanation and present both cases;
- datums: the plural of “datum” is “data”. If one is tempted to use “datums”, change it to “datum points” or “datum lines” or “datum planes” as the case may be;
- utilise: use “use” instead;
- “in other words”: this phrase is often used to join two alternative definitions of a term or concept: the alternative definitions should be reviewed and reconciled.

4.11 Frequently used words

The following terms are used frequently in parts of SC4 standards. To ensure editorial consistency, they should be used only in precisely defined contexts.

- between/among: use “between” to mean “exactly two;” use “among” to mean “two or more than two.” See [3].
- construct(s): do not use this word without a qualifier. The term “resource constructs” is defined in ISO 10303-1; use it only as defined there. “EXPRESS constructs” should not be used; use “EXPRESS declarations” or “elements” instead. Any other use of “construct” should have a qualifier and appear in the definitions clause of the part first defining it.
- data: “data” is a plural noun and requires a plural verb, that is, “data are” not “data is”.
- if: if an “if” clause ends in a comma, do not follow it with the word “then”.
- part: the use of “part” may be confusing. To refer to a part of an SC4 standard, always use “this part of ISO <ISO standard number>.” (See also 4.6.1)
- presentation: do not use “presentation” for “representation”. “Presentation” should be restricted to situations with visual aspects;
- schema: the plural of “schema” is “schemas”, not “schemata”;
- which: do not use “which” in place of “that”. “That” introduces a defining phrase; “which” introduces an informational phrase. See [5].

4.12 Representation of dates

All SC4 standards shall conform to ISO 8601. In particular, all calendar dates shall be in the form yyyy-mm-dd, utilizing the four-digit date, as prescribed in clause 5.2.1.1 of ISO 8601. Thus, the date April 26, 2001 is represented as 2001-04-26.

5 Format and layout of SC4 standards

5.1 Page size, fonts, and spacing

5.1.1 Page size and margin settings

Prepare all parts of SC4 standards to be printed on A4 (metric standard) paper stock.

NOTE 1 For other page sizes, such as US letter size (8.5in x 11in), documents formatted for A4 paper can be printed from a PDF file using the “print to fit” option in the Adobe® Acrobat® reader. The requirement to deliver SC4 standards in PDF form (see 5.1.2) removes the need to format source documents for paper sizes other than A4, as was permitted by the previous edition of the Supplementary directives.

Margins should be set so that text is centred horizontally and vertically on the page.

NOTE 2 The requirement to centre the text does not refer to line justification, rather positioning text on the printed page.

The margins should be 25mm/1in on the left and right sides of the page and 12mm/0.5in at the top and bottom of the page. Headers and footers shall be placed 12mm/0.5in from the top and bottom of the page respectively. Figure 2 illustrates the required page layout.

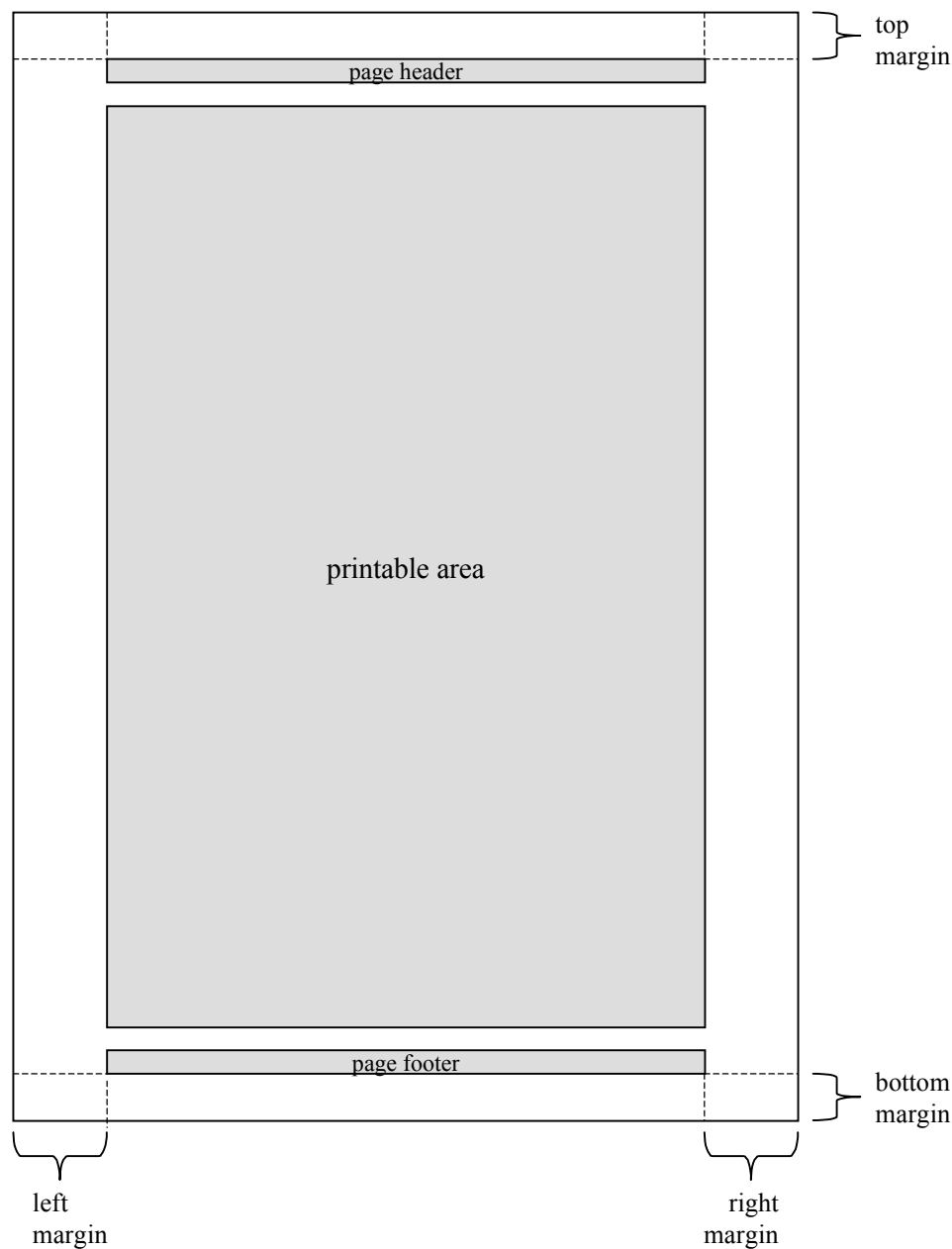


Figure 2— Page layout

NOTE 3 In some word processors, including Microsoft® Word, the “top margin” and “bottom margin” settings determine the spacing between the edge of the page and the main text area, excluding headers and footers. The margin settings recommended above can be achieved in Word by setting the top and bottom margins to be 25mm/1in and the header and footer spacings to be 12mm/0.5in from the edge of the page.

Many parts of ISO 10303 that are based on the Supplementary directives for drafting and presentation of ISO 10303 [23] use a top margin and bottom margin setting of 25mm/1in. Parts of ISO 10303 that are at DIS level or higher at the time of publication of these SC4 Supplementary directives may con-

tinue to follow the older convention for margin settings, unless otherwise advised by the ISO Central Secretariat, the SC4 Secretariat, or the SC4 Quality Committee.

Except for pages that are to be printed in landscape mode, margin settings shall be consistent throughout the document. If it is necessary to accommodate a table or figure in landscape mode, the left and right margins may be reduced but the top and bottom margins shall not be. If any pages are to be printed in landscape mode, page headers and footers shall remain in the same position and orientation as in portrait mode, as shown in Figure 3.

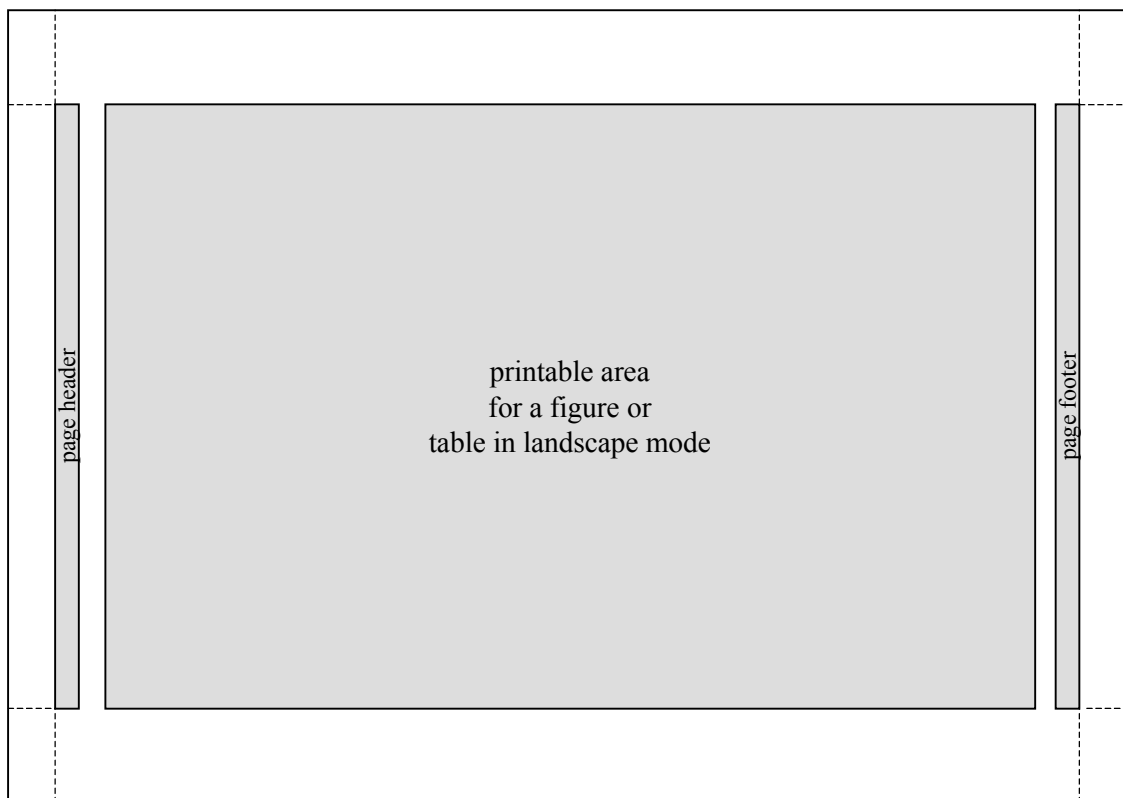


Figure 3— Page layout for figures or tables in landscape mode

Use of landscape mode for figures and tables in SC4 standards is deprecated with the following exceptions:

- mapping tables of STEP application protocols that use the format specified in the Guidelines for the development of mapping tables (see 9.7.1);

NOTE At the time of publication of this document, the Guidelines for the development of mapping specifications was also being prepared for publication. The requirements of the revised guidelines apply to all ISO 10303 application protocols approved as New Work Items after the publication of the revised guidelines.

- IDEF0 activity model diagrams (see 9.9.2.1.2).

If projects wish to use landscape mode for other types of figure or table the requirement should be discussed with the SC4 Quality Committee.

5.1.2 Acceptable digital formats

Editors shall submit their documents to the SC4 Secretariat, for ballot or publication, in Portable Document Format (PDF). Information on the ISO Central Secretariat's requirements for PDF documents is available on the Internet:

<http://www.iso.ch/itsige/guide/200-Annex-6.html>

Editors may use any tool they wish to produce the documents and then convert them into PDF.

NOTE The SC4 Quality Committee has developed lists of tools useful for project teams and editors (see QC N189).

5.1.3 Acceptable fonts

Table 2⁴⁾ lists acceptable fonts for preparing SC4 standards that are delivered as PDF files. These fonts may be embedded into the PDF file without any special licensing requirement.

Table 2 — Acceptable fonts for PDF file creation

Type 1 Base 13 fonts in ATM environment	TrueType (MS Windows)
Times (Regular, Italic, Bold, Bold Italic)	Times New Roman (Regular, Italic, Bold, Bold Italic)
Helvetica (Regular, Oblique, Bold, BoldOblique)	Arial (Regular, Italic, Bold, Bold Italic)
Courier (Regular, Oblique, Bold, BoldOblique)	Courier New (Regular, Italic, Bold, Bold Italic)
Symbol	Symbol

A given document should contain only T1 or TT type fonts and not both.

Avoid the use of any other fonts. If additional fonts are needed then try to obtain them from widely used resources, such as products like WordPerfect 8, CorelDraw 7, Adobe Illustrator 7, and Adobe Type on call. Be sure to check the license on the fonts and the conditions under which such fonts may be distributed.

Each SC4 standard uses a consistent set of fonts and font sizes. Documents that are prepared using the ISO Central Secretariat's template for Microsoft® Word shall use the fonts and font size specified in that template.

Other documents shall use the fonts, font sizes, and enhancements specified in Table 3. Two combinations of fonts and font size are specified in this table. Columns headed "A" specify the fonts and font sizes for all parts of ISO 10303. Other SC4 standards may use the font and font sizes specified in the columns headed "A" or those in the columns headed "B".

EXAMPLE All parts of ISO 15926 and all parts of ISO 18876 use the alternative fonts and font sizes specified in the columns headed "B".

⁴⁾ This table and the text that follows it are taken from the ISO Central Secretariat's "Guide for the use of IT in the development and delivery of standards", annex F "Recommendations for the creation of PDF files".

Table 3 — Fonts, font sizes, and enhancements for SC4 standards

Document element	Font		Font size		Enhancement
	A	B	A	B	
Title	Times New Roman	Arial	17pt	16pt	bold
Headings of the foreword, introduction, table of contents, clauses, annexes, bibliography, and index.	Times New Roman	Arial	14pt		bold
Headings for level 2 subclauses (x.y)	Times New Roman	Arial	12pt ^a		bold
Headings for level 3 subclauses (x.y.z) and lower level subclauses, titles of figures and tables, page headers	Times New Roman	Arial	11pt ^a		bold
General text; page footers; definitions of terms; entries in the table of contents, normative references, bibliography, and index; any other elements for which font information is not specified	Times New Roman		11pt	10pt	none
References to the names of EXPRESS constants, types, entity data types, functions, rules, and procedures where they occur in general text	Times New Roman		11pt	10pt	bold
EXPRESS keywords where they occur in general text	Courier New		10pt	9pt	none
Annotation in figures	Times New Roman		8pt – 11pt	8pt – 10pt	none
Entity data type names in EXPRESS-G diagrams	Times New Roman		11pt	10pt	none

Table 3 — Fonts, font sizes, and enhancements for SC4 standards (concluded)

Document element	Font		Font size		Enhancement
	A	B	A	B	
Attribute names and labels in EXPRESS-G diagrams	Times New Roman		11pt	10pt	none
Notes, examples, footnotes, copyright statement on page ii	Times New Roman		10pt	9pt	none
EXPRESS language code, Internet URLs	Courier New		10pt	9pt	none
Footnote references ^b	Times New Roman		8pt	7pt	superscripted
NOTE The font names used here are those of TrueType fonts. Equivalent Type 1 fonts (see Table 2) may also be used.					
^a Parts of ISO 10303 that are based on the Supplementary directives for drafting and presentation of ISO 10303 [23] use 14pt size for all clause and subclause headings, independent of level. Parts of ISO 10303 that are at DIS level or higher at the time of publication of these SC4 Supplementary directives may continue to follow the older convention for font sizes.					
^b The size of footnote references may be automatically set by word processor or publication tools, based on the size of the text in which the footnote reference is inserted. The font sizes stated here should be used only if footnote references are not formatted automatically by the system being used.					

Unacceptable font sizes used to prepare parts of SC4 standards are anything below 8 point.

5.1.4 Vertical spacing

Vertical spacing between elements should be used to give a consistent and readable layout to the document, without introducing excessive whitespace. Table 4 provides guidance on the vertical spacing to be used between elements. The unit of measure for vertical spacing in Table 4 is one blank line which refers, by default, to a single spaced line corresponding to the font size in use.

EXAMPLE 1 For 11pt text, text is normally set on horizontal lines 12pt apart.

Each entry in Table 4 corresponds to the spacing between an element of the type listed in the first column and an element of the type listed in the first row. A blank entry indicates that a given combination of elements cannot occur.

EXAMPLE 2 The title element cannot follow anything other than a page header.

Table 4 — Vertical spacing

second element	first element	page header	title element	clause headings	first level subclause headings	other subclause headings	annex headings	other headings ^a	paragraphs, items in lists	notes and examples	figures	figure titles	tables	table titles
page header			5	2 ^b	1.5 ^b	1 ^b	2	2	1 ^b	1 ^b	1 ^b			1 ^b
title element				2										
clause headings					1.5				1	1 ^c	1 ^c			1 ^c
first level subclause headings						1			1	1 ^c	1 ^c			1 ^c
other subclause headings						1			1	1 ^c	1 ^c			1 ^c
annex headings					1.5				1	1 ^c	1 ^c			1 ^c
other headings ^a					1.5 ^d				1	1 ^c	1 ^c			1 ^c
paragraphs, items in lists				2	1.5	1			1	1	2			1
notes and examples				2	1.5	1			1	1	2			1
figures												1		
figure titles				2	1.5	1			1	1	2			1
tables				2	1.5	1			1	1	2			1
table titles													1	

Table 4 — Vertical spacing (concluded)

second element	page header	title element	clause headings	first level subclause headings	other subclause headings	annex headings	other headings ^a	paragraphs, items in lists	notes and examples	figures	figure titles	tables	table titles
<p>^a Other headings are those of the table of contents, foreword, introduction, bibliography, and index.</p> <p>^b These elements are not required to be at the start of a new page; the spacing given is that which applies when these elements happen to be at the start of a new page.</p> <p>^c These combinations of elements are of limited use; notes, examples, figures, and tables should normally follow text in a paragraph or list, or other notes, examples, figures, or tables</p> <p>^d This combination is possible only when the introduction has subdivisions (see 4.1.5)</p>													

Some variation is permitted with respect to the spacings given in Table 4 as long as the final visual appearance of the document is not significantly impacted.

NOTE If a project needs to make use of alternative vertical spacing, the project leader should discuss this need with the SC4 Quality Committee.

5.2 Instructions for the page layout for parts of SC4 standards

This subclause gives rules and guidelines specific to the layout for all parts of SC4 standards.

5.2.1 Page headers and footers

5.2.1.1 General requirements for page headers

Except for the cover page and the page on which the title element (see 4.2.2) appears and the scope clause (see 4.2.3) begins, a page header (sometimes referred to as a “page heading” or “running head”) shall appear on every page of the document. See 5.2.1.2 for instructions regarding the “special” header to be used on page 1 of each standard.

The page header shall state the correct reference for the standard; this includes an indication of its status, its ISO number and part number, and (for FDIS, IS, and TS documents only), the year and language of publication.

The page header shall be presented in the same font as that used for general text, in boldface, and shall be separated from other text on the page by at least one blank line (see Table 4).

When placed on a right-hand (odd-numbered) page, this information shall be on the right. When placed on a left-hand (even-numbered) page, this information shall be on the left. The page heading shall be right-justified on right-hand pages and left-justified on left-hand pages.

Table 5 specifies the wording to be used in page headers. Substitute the ISO standard number for “sssss”, the part number for “ppp”, and (for FDIS, IS, and TS documents) the year of publication for “yyyy”.

Table 5 — Wording for document reference in page headers

Stage	Document reference	Notes
Working draft, prior to first Committee Draft	ISO/WD sssss-pp	All working drafts at this stage have the same formal document reference. Projects may, however, add additional information to uniquely identify working drafts, such as “ISO/WD.1 ...”, “ISO/WD.2 ...”, ...
First Committee Draft	ISO/CD sssss-ppp	There is no provision to indicate an edition in the document reference; the “.2” here indicates a second CD, not a second edition.
Second Committee Draft	ISO/CD sssss-ppp.2	
First Committee Draft for a document that is to be published as a Technical Specification	ISO/CD TS sssss-ppp	
Draft International Standard	ISO/DIS sssss-ppp	
Final Draft International Standard	ISO/FDIS sssss-ppp:yyyy(E)	Check publication dates with the SC4 Secretariat; documents submitted to ISO CS at the end of one year may have to be dated for the following year
International Standard	ISO sssss-ppp:yyyy(E)	

For documents at stages 20 (Working Draft), 30 (Committee Draft/ Preliminary Draft Technical Specification), the Quality Committee recommends that editors include the document N- number in the page headers, opposite the document reference.

NOTE Requirements for the contents of page headers have changed since the previous edition of the Supplementary directives; do not use older documents as a model.

EXAMPLE 1 The following example illustrates the page header for a Committee Draft document (right-hand page):

ISO/CD 10303-54

EXAMPLE 2 The following example illustrates the page header for a Final Draft International Standard (left-hand page):

ISO/FDIS 15531-42:2002(E)

5.2.1.2 “Special” header on page 1

For the page on which the title element (see 4.2.2) appears and the scope clause (see 4.2.3) begins, use the following page header instead of that specified in 5.2.1.1. The “special” header consists of two elements, as described in Table 6.

Table 6 — Typical “special” page/header elements

Document type / stage	Left element	Right element
20	WORKING DRAFT	ISO/WD sssss-ppp
30 (document is targeted at International Standard)	COMMITTEE DRAFT	ISO/CD sssss-ppp
30 (document is targeted at Technical Specification)	COMMITTEE DRAFT	ISO/CD TS sssss-ppp
40	DRAFT INTERNATIONAL STANDARD	ISO/DIS sssss-ppp
50	FINAL DRAFT INTERNATIONAL STANDARD	ISO/FDIS sssss-ppp:yyyy(E)
60 (document is an International Standard)	INTERNATIONAL STANDARD	ISO sssss-ppp:yyyy(E)
60 (document is a Technical Specification)	TECHNICAL SPECIFICATION	ISO/TS sssss-ppp:yyyy(E)

This page header shall be in bold face. The left element shall be aligned flush left. The right element shall be aligned flush right. There shall be a horizontal rule above and below the page header, separated from the text by approximately 0.1 in/2 mm/6 pt from the text.

EXAMPLE 1 The example below illustrates the required content and format of the page 1 header for a Committee Draft, where the document is intended to be published as a Technical Specification

COMMITTEE DRAFT	ISO/CD TS 18876-2
------------------------	--------------------------

EXAMPLE 2 The example below illustrates the required content and format of the page 1 header for a published international standard:

INTERNATIONAL STANDARD	ISO 10303-43:2000(E)
-------------------------------	-----------------------------

5.2.1.3 Page footers

All pages apart from the cover page shall have a page footer at the bottom of the page. The page header shall be presented in the same font as that used for general text, and shall be separated from the text on the page by at least one blank line.

The contents of the page footer shall be as follows. On right-hand (odd-numbered) pages, the page footer shall contain:

- a copyright notice, worded “© ISO <year of publication> – All rights reserved” on the left-hand side of the page footer;
- the page number, on the right-hand side of the page footer.

On left-hand (even-numbered) pages, the page footer shall contain:

- the page number, on the left-hand side of the page footer;
- a copyright notice, worded “© ISO <year of publication> – All rights reserved” on the right-hand side of the page footer.

NOTE 1 All pages shall include a copyright notice, independent of the stage of the document in the standardization process. This is a change to the requirements of the previous edition of the Supplementary directives; do not follow the example of older documents.

Pages shall be numbered as follows:

- pages containing the preliminary elements (cover page, table of contents, foreword, and introduction) shall be numbered using lower case Roman numerals;
- the cover page shall not be numbered;
- the reverse of the cover page shall be numbered “ii”;

NOTE 2 The ISO Central Secretariat will prepare the final cover page and its reverse for IS or TS publication.

- the first page of the table of contents shall be numbered “iii”;
- remaining pages containing preliminary elements shall be numbered “iv”, “v”, and so on;
- the page containing the title element (see 4.2.2) and the start of the scope clause (see 4.2.3) shall be numbered using the Arabic numeral “1”;
- all remaining pages shall be numbered using Arabic numerals in sequence, “2”, “3”, and so on.

Page numbers for pages within annexes shall not be prefixed with the letter identifier of the annex.

EXAMPLE 1 The example below illustrates the required content and format of a page footer (right-hand page in the preliminary matter):

© ISO 2001 – All rights reserved

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EXAMPLE 2 The example below illustrates the required content and format of a page footer (left-hand page in the main part of a document):

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© ISO 2001 – All rights reserved

5.2.2 Use of blank pages

To allow the Scope clause to begin on a right hand (odd-numbered) page, a blank page may be inserted after the last page of the introduction if that page is odd numbered. This additional page shall have the same page headers (see 5.2.1.1) and footers (see 5.2.1.3) as other pages in the preliminary part of the document. This page shall not include any other text such as “This page left blank” or “Blank page”. This is the only place where a blank page can be inserted in an SC4 standard.

5.3 General format and layout instructions

5.3.1 Format and layout of clauses and subclauses

All clauses, subclauses, and subdivisions of subclauses shall begin flush left without indentation. All text shall be single-spaced and should be prepared using full justification. Words shall have a single space between them; sentences should have a single space between them. Because some word processors introduce additional space between words to provide full justification, excess whitespace may be produced making the text difficult to read. Use hyphenation to avoid this.

NOTE This can be a problem with text that includes the names of EXPRESS objects. Inclusion of “soft hyphens” in the names of the EXPRESS objects helps to reduce or eliminate excess whitespace.

No line of text shall extend into any margin.

In general, beginning with the first page of the scope clause, clauses throughout the main body of the text shall follow each other without page breaks. Because parts of SC4 standards often contain a large number of pages making them difficult to edit when this rule is followed, ISO Central Secretariat has relaxed the rule for SC4. However, the start of a new clause is the only place where text may begin on a new page. The two methods of breaking pages may be combined in the same document. Short clauses should follow each other without page breaks.

The table of contents, the foreword, the introduction, the scope clause, each annex, the bibliography, and the index shall each begin on a new page.

5.3.1.1 Clause and subclause headings

A clause or subclause heading is the wording used to introduce a clause or subclause.

Clause and subclause headings shall begin flush left on a line by themselves. Beginning with the scope clause, all headings shall be numbered with Arabic numbers in sequence. The number for each clause headings shall be followed by at least two spaces and the text of the headings.

The first word in all headings shall be capitalized. All other words in the heading shall be lower case unless they are proper nouns.

EXAMPLE The following example illustrates the format and capitalization of a first level subclause heading.

4.1 Units of functionality

This requirement may be superseded by specific requirements for clauses that contain the definitions of EXPRESS elements (see 6.4).

If a heading “wraps around” to a second line, that second line shall begin flush left directly beneath the first character of the line above (under the clause number). Long titles that wrap around should be avoided, if possible.

No clause or subclause heading shall appear by itself at the bottom of a page. A heading that would normally do this should be forced to the top of the next page by use of suitable paragraph styles or by manual insertion of a page break.

5.3.1.2 Paragraphs

Paragraphs are subdivisions of clauses or subclauses. Paragraphs shall be unnumbered and untitled. All text shall be single spaced without indentation.

5.3.1.3 Orphans and widows

When a page break occurs in mid-paragraph, care shall be taken not to have the first or last line of a paragraph appear on a page by itself. Printing the first line of a new paragraph as the last line on a page is referred to as “creating an orphan”. Printing the last line of a paragraph as the first line of a new page is referred to as a “creating a widow”. Orphans and widows shall not appear in general text or EXPRESS statements.

Clause and subclause headings, titles for tables, and EXPRESS delimiters shall not appear at the bottom of a page without at least two lines of the text following them.

NOTE 1 The requirement to avoid widows and orphans can normally be satisfied using the appropriate settings in a style sheet.

NOTE 2 If any manual insertion of page breaks is necessary to meet this requirement, the editor should do so immediately prior to release for ballot.

5.3.1.4 Annex headings

The first word of the first heading in each annex shall be “Annex” followed by a space and a capital letter designating the serial order of the annex. This order shall begin with the letter “A” and continue through the alphabet bypassing the letter “I”. The heading, including the title, shall be in 14 point size, in boldface, and centred on the line (see 4.1.3). On the next line, the word “normative” or “informative” shall appear in parentheses and shall be followed by a blank line. The parentheses and the word “normative” or “informative” [cap and “” for words used as words?] shall be in the same font and point size as the annex heading and shall be centred on the line but shall not be in boldface. The title of the annex shall be centred on the line and shall be in boldface on a line below the blank line that follows the word (normative) or (informative). A single annex shall be called “Annex A.” A model for an annex that is normative is:

[ISO 10303 required]

Annex <N>
(normative)

Title of annex

<text of annex or subclause (N.1) heading starts here ...>

[end required]

Replace <N> with the correct letter for the annex.

5.3.1.5 An annex of examples

When an annex only contains examples, the text size for the text of the annex shall be the regular size and not that normally required for examples. This annex is informative.

5.3.2 Format and layout of lists

Each item in an unordered list shall be preceded by a long dash (“emdash”) followed by one or more blank space (see Example 1).

EXAMPLE 1 The following items form an unordered list:

- first item,
- second item,
- third item.

The following summarizes requirements for the format of unordered and ordered lists:

- Lists may be nested up to four levels (although lists with more than two levels are discouraged).
- For ordered lists, use lower case letters followed by a right parenthesis followed by a blank space for level 1, Arabic numerals for level 2, lower case Roman numerals followed by a right parenthesis followed by a blank space for level 3, and upper case Roman numerals followed by a right parenthesis followed by a blank space for level 4.
- In all cases, follow the letter/ number by a right parenthesis.
- Use ordered lists when there is a requirement to make reference to specific items in the list; use unordered lists otherwise.
- For unordered lists use long dashes (emdash, —) to introduce items at any level.

NOTE Although ISO CS permits using bullets for unordered lists, SC4 has agreed that this option is deprecated in favour of the emdash.

- The dash or letter preceding a level 1 list item shall not be indented from the left margin.
- The text of each level 1 item should start approximately 0.25 inches / 6.5mm / 18pt from the left margin, and this indentation should repeatedly apply to the second and subsequent lines of the list item.
- The number preceding a level 2 list item shall be indented approximately 0.25 inches / 6.5mm / 18pt from the left margin.
- The text of each level 2 item should start approximately 0.5 inches / 13mm / 36pt from the left margin, and this indentation should apply to the second and subsequent lines of the list item.

The following examples illustrate the correct formats for lists.

EXAMPLE 1 The following items form an unordered list.

Text xxxx:

- xxxxx;
- xxxxx;
- xxxxx.

EXAMPLE 2 The following unordered list includes items at two levels.

Text xxxx:

- xxxxx
 - yyyyy;

— yyyy;

— xxxxx.

EXAMPLE 3 The following items form an ordered list.

Text xxxx:

- a) xxxxx;
- b) xxxxx;
- c) xxxxx.

EXAMPLE 4 The following ordered list includes items at two levels.

Text xxxx:

- a) xxxxx
 - 1) yyyy;
 - 2) yyyy;
- b) xxxxx.

If the text of an item being listed wraps to the next line, the second line of the text shall be aligned with the start of the text of the first line (see Example 1 in 4.5).

NOTE The lists in this standing document follow this format.

5.3.3 Format and layout of figures

5.3.3.1 Placement of figures

All figures shall appear immediately following their first reference. Figures shall appear on the same page as the first reference to the figure if space and context permit. Otherwise, the figure shall appear on the page immediately following the reference.

Where a figure appears on the same page as text, the figure shall, whenever possible, be placed at the top or bottom of the page. When a figure must be placed in mid-page, it shall be separated from the text by two blank lines before the figure, one blank line between the figure and the title, and one blank line between the title and the text that follows. A figure shall not be placed in the middle of a paragraph.

The top of a figure printed in landscape mode shall be at the left-hand margin on either left or right-hand pages.

5.3.3.2 Format for figures

Figures shall be in the form of line drawings. Black and white photographs may be used if such photographs enhance the understandability and use of the standard and it is not possible to convert them into line drawings. (See 6.6.4.2 of the ISO/IEC Directives Part 3). The content of the figure shall be centred. Text in figures shall be in 8 to 11 point. The point size of text shall be consistent across a set of figures.

5.3.3.3 Placement of figure numbers and titles

Figure numbers and titles shall be centred below the figure. The figure number shall follow the word “Figure” and shall be followed by a blank space, an emdash, another blank space, and the title of the figure. Only the first word in the title is capitalized. The figure number, and title shall be on the same line. If the figure is printed on the page in landscape mode, the figure number and title shall appear below the figure as the figure is read, that is, along the right hand margin of the page.

EXAMPLE The following is an example of a figure title:

Figure 1 — Title of figure

5.3.4 Format and layout of tables

5.3.4.1 Placement of tables

All tables should appear immediately following their first reference. Tables should appear on the same page as the first reference to the table if space and context permit. Otherwise, the table shall appear on the page immediately following the first reference.

Where a table appears on a page containing text, the table should, whenever possible, be placed at the top or bottom of the page. When a table is placed in mid-page, it should be separated from the text by at least one blank line before and after the table. A table should not be placed in the middle of a paragraph. The top of a table printed in landscape mode shall be at the left margin on either left or right-hand pages.

5.3.4.2 Format for tables

Each table shall be bordered by single lines unless the addition of these lines causes a table that would fit on a single page to be continued on another page. The headings for each column shall be in bold-face, centred within the column, and separated from the elements of the column by a double line. All other table columns and rows shall be separated by single lines. There are two exceptions to this rule:

- mapping tables of ISO 10303 application protocols shall use double lines to separate mappings for each application object (see 9.7.1);
- test case input specification tables in ISO 10303 abstract test suites shall use double lines to separate groups of data related to individual application objects (see 9.6.2).

See clause 4, Table 1 for an example of the format for a table.

5.3.4.3 Placement of table numbers and titles

Table numbers and titles shall be centred above the table. The number shall follow the word “Table” and be followed by a space, a dash, a space, and the title of the table on the same line. If a table is printed on a page in landscape mode, the table number and title shall still appear above the table.

EXAMPLE The following is an example of a table title:

Table 1 — Title of table

5.3.5 Layout and format of notes

Each note shall be separated from the body of the clause, subclause, or paragraph to which it refers by a single blank line. Each note shall be followed by a single blank line. Use a smaller size of the same typeface as used for normal text. See 5.1.3 for details of the fonts and font sizes to be used for notes.

Notes shall not be indented from the left margin.

Use whitespace to separate the word “NOTE” (and the accompanying number, if present) from the text of the note. This whitespace should be 0.1-0.2in/3-5mm, and should be consistent so that the text of adjacent notes or adjacent examples is aligned. Do not use a hyphen to separate the word “NOTE” from the text.

EXAMPLE An example of the format and layout for notes is shown in Figure 4.

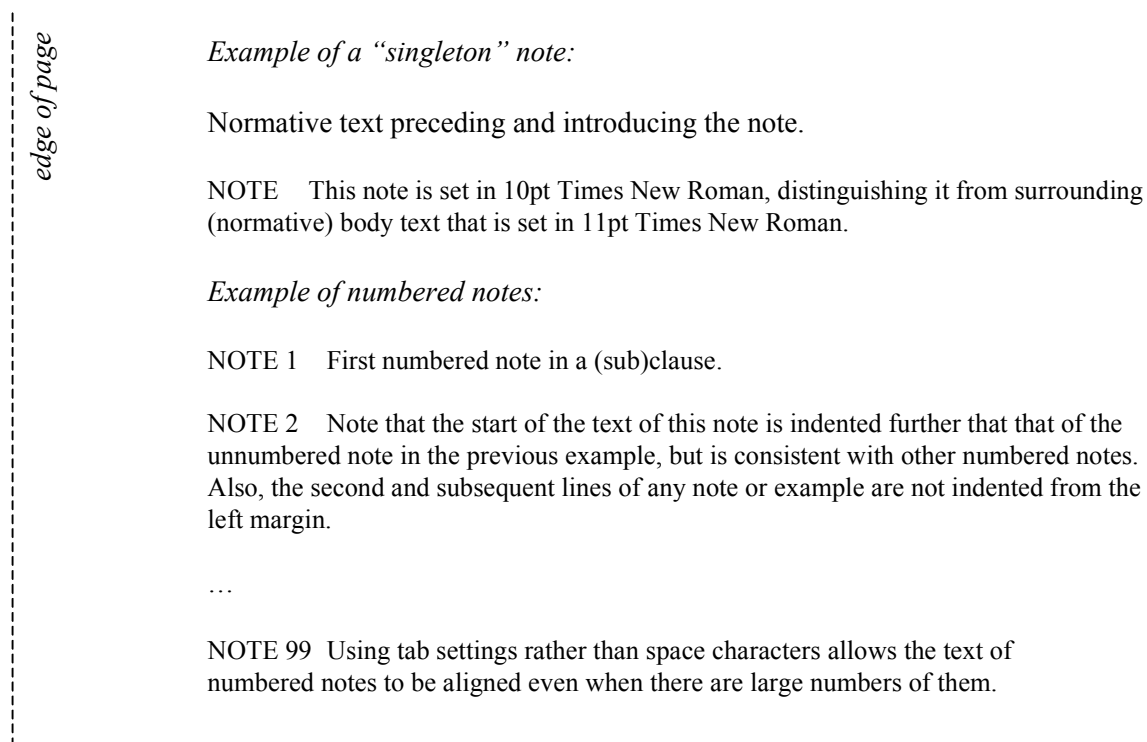


Figure 4 — Examples showing the format and layout of notes

5.3.6 Layout and format for examples

Each note shall be separated from the body of the clause, subclause, or paragraph to which it refers by a single blank line. Each note shall be followed by a single blank line. Use a smaller size of the same typeface as used for normal text. See 5.1.3 for details of the fonts and font sizes to be used for notes.

Examples shall not be indented from the left margin.

Use whitespace to separate the word “EXAMPLE” (and the accompanying number, if present) from the text of the example. This whitespace should be 0.1-0.2in/3-5mm, and should be consistent so that the text of adjacent examples or adjacent examples is aligned. Do not use a hyphen to separate the word “EXAMPLE” from the text.

EXAMPLE An example of the format and layout of examples is shown in Figure 5.

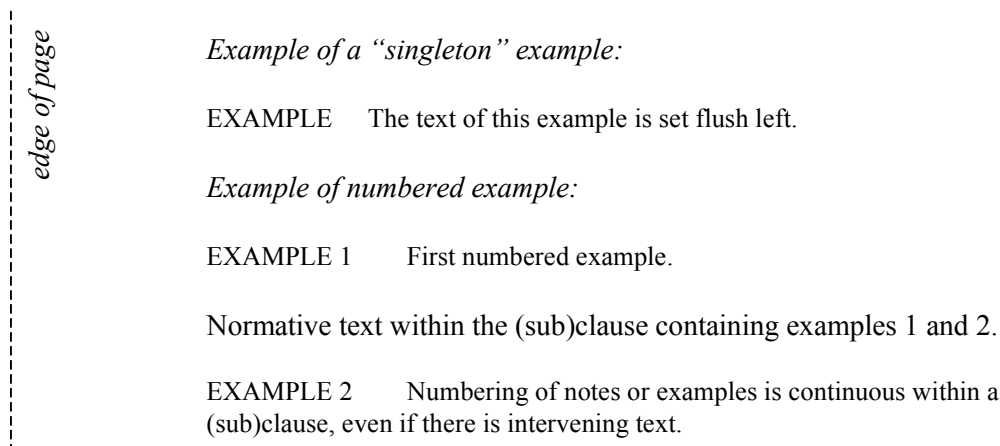


Figure 5 — Examples showing the format and layout of examples

5.4 Format and layout of specific elements

5.4.1 Format and layout of the table of contents

The titles “Contents”, “Figures”, and “Tables” shall begin flush left with a single blank line between the title and the list. There shall be two blank lines preceding the titles “Figures” and “Tables”. The word “Page” shall appear above the column of page numbers on the first page of the table of contents. It shall appear on the same line as the title “Contents” and shall be flush right. There shall be dot leaders between the end of the listed items and the page numbers. All page numbers shall be aligned flush right. The table of contents shall begin on page “iii”.

NOTE 1 The ISO Central Secretariat prefers to receive documents (as PDF files) that start at page iii, allowing them to prepend the cover page and copyright page.

The titles of clauses, annexes, figures, and tables (including their numbers) listed in the table of contents shall be aligned flush left. The first level subclause titles (including their numbers) listed in the table of contents shall be indented approximately 6mm/0.25in from the left margin. The second level subclause titles (including their numbers) listed in the table of contents shall be indented approximately 12mm/0.5in from the left margin.

The entry for each clause or annex shall be separated from the text that precedes it by one blank line.

NOTE This standing document’s table of contents follows this format.

5.4.2 Placement of the foreword

The foreword shall begin on a new page immediately following the table of contents. The pages of the foreword shall be numbered with Roman numerals following the sequence already established. There shall be one blank line between the title “Foreword” and the first line of the text.

5.4.3 Placement of the introduction

The introduction shall begin on a new page immediately following the foreword. The pages of the introduction shall be numbered with Roman numerals following the sequence already established. There shall be one blank line between the title “Introduction” and the first line of the text. If the Intro-

duction ends on an odd-numbered page, a blank page shall be inserted before the page on which the scope clause begins (see 5.2.2 for further details).

5.4.4 Format and layout of the title element

All titles shall have a capital letter on the first word of each section. All other words in the section shall be lower case. For the most part, sections of the title should be kept together. However, if they are short, sections may be combined as has been done in the example that follows. If word wrapping is necessary, sections of the title should be broken at the end of a section as has been done in the example that follows. “Part <part number>:” shall always appear on a line by itself.

EXAMPLE The title element for ISO 10303-11 is as follows:

**Industrial automation systems and integration —
Product data representation and exchange —
Part 11:
Description methods: The EXPRESS language reference
manual**

The title shall appear at the top of the first page of the main body of text (the page on which the scope clause begins). The title shall begin flush left. See 5.1.3, Table 3 for information about the fonts that may be used for the title element. The punctuation at the end of the first two sections is an emdash (long dash). There shall be one blank space after the colon that follows the series designator. See 5.1.4, Table 4 for information about the vertical spacing to be used before and after the title element.

5.4.5 Layout and format of normative references

Normative references presented in the following format (conforming to ISO 690). The standard reference number shall appear in Roman (non-italic) typeface followed by a colon, the date of publication, a comma, and the title of the standard in italic. Each normative reference shall finish with a period. Normative references shall be separated from each other by a blank line. Normative references are not indented from the left margin.

5.4.6 Layout and format of terms and definitions

Each term being defined shall occupy its own numbered subclause. The heading for the subclause shall be the term being defined. The subclause number, the term (together with any synonyms or abbreviations), and the definition of the term shall appear on separate lines. The subclause number and the term shall appear boldface in the same font and font size as general text. There shall be no additional vertical spacing between the subclause number and the term or between the term and its definition. Do not place a colon after term. Do not place a period after the definition.

EXAMPLE The following example illustrates the format and layout of a definition:

**3.2.3
widget**
small part that is left over at the end of every assembly process

NOTE The definitions in clause 3 of this document are presented in this format.

5.4.7 Format for the index

The index shall begin on a new page. The title “Index” be flush with the left margin at the top of the first page of the index. The terms contained in the index shall be presented as a single column and shall consist of an alphabetical list of terms addressed in the standard, followed by dot leaders and the number of the page on which the term appears. Page numbers shall be flush right.

6 EXPRESS presentation style

This clause gives rules and guidelines specific to documenting EXPRESS. The subjects covered are as follows.

- Layout: explains how to use indentation, blank lines, and other white space to produce a consistent layout (see 6.1).
- Style: deals with naming conventions that are to be used for all schemas developed for SC4 standards (see 6.2).
- Usage: defines rules for the use of EXPRESS language elements in SC4 standards (see 6.3).

NOTE See also the Guidelines for application interpreted model development, the Procedures for application interpretation [5], and Syntactic and semantic rules [23] for further guidance on the use of EXPRESS in ISO 10303.

- Documentation requirements for definitions of EXPRESS schemas (see 6.4).
- The layout and format to be used for EXPRESS-G diagrams (see 6.5).

6.1 Layout rules

The layout rules explain how to use white space to produce a schema that has a uniform appearance. A uniform appearance helps the reader to find and use the material of interest.

To prevent unusual spacing, use left justification for EXPRESS language statements, not full justification. See 5.1.3 for text fonts to be used in documenting EXPRESS.

Most word processors and authoring tools provide capabilities to prevent widows and orphans in EXPRESS statements. These should be used in preference techniques such as manual insertion of page breaks or additional whitespace.

EXAMPLE 1 In Corel™ WordPerfect, use block protection or conditional end of page.

EXAMPLE 2 In Microsoft® Word, use paragraph styles with Widow/Orphan control, Keep lines together, and Keep with next as appropriate.

Because of the variability of the size of EXPRESS declarations, no hard rule can be given for the number of lines to force on one page. Do not insert extra page breaks. (See 5.3.1.3 for rules on widows and orphans that pertain to EXPRESS statements.)

6.1.1 Organization of the schema elements

Schema elements shall be written in the order specified in Table 7. None of these elements are mandatory; only include these elements as needed (see also 6.4).

Table 7 — Order of declarations of schema elements

Declaration type	EXPRESS keyword
Interface statements	USE or REFERENCE
Constants	CONSTANT
Types	TYPE
Entity data types	ENTITY
Functions	FUNCTION
Rule	RULE
Procedure	PROCEDURE

6.1.2 Use of the colon

When used in an attribute declaration, at least one space shall be placed before the colon that follows the attribute identifier. One space shall be placed between the colon and the identifier that specifies the domain of the attribute. When there is more than one attribute declaration within an entity data type declaration, additional space can be used between the attribute identifier and the colon to align the colons in tabular fashion, when possible.

EXAMPLE 1 The following example illustrates alignment of the colons in attribute declarations:

```
ENTITY e1;
  first  : INTEGER;
  second : STRING;
END_ENTITY;
```

When used in a label, no space shall separate the label name from the colon.

EXAMPLE 2 The following example illustrates the placement of colons in labels:

```
ENTITY e2;
  first  : INTEGER;
  second : STRING;
UNIQUE
  UR1: second;
WHERE
  WR1: first > 5;
END_ENTITY;
```

6.1.3 Use of the semicolon

A space shall not appear before a semicolon, and a semicolon shall not appear at the beginning of a line.

EXAMPLE 1 The following example illustrates correct placement of semicolons:

```
ENTITY e1;
  first : INTEGER;
```

```
second : STRING;
END_ENTITY;
```

EXAMPLE 2 The following example illustrates incorrect placement of semicolons:

```
ENTITY e1 ;
  first : INTEGER
;
  second : STRING
;END_ENTITY ;
```

6.1.4 Commenting conventions

It should be possible to extract an EXPRESS data specification (one or more schema declarations) defined in an SC4 standard from the source description of the part of ISO 10303 by regarding all material that is not part of the EXPRESS declarations as comments. Accordingly, EXPRESS declarations shall be separated from the surrounding text by EXPRESS embedded remark markers (“(*)” and “(*)”). The closing marker shall appear by itself on the line immediately preceding the EXPRESS object description, and the opening marker shall appear by itself on the line immediately following the description of the EXPRESS object.

EXAMPLE 1 The following example illustrates the use of embedded remark markers:

```
*)
ENTITY e1;
  first : INTEGER;
  second : STRING;
END_ENTITY;
(*)
```

NOTE This implies that to process the complete document as EXPRESS, it may be necessary to add one opening marker at the beginning of the document and one closing marker at the end of the document.

Material not intended to describe a requirement, such as examples or notes that include EXPRESS code, shall not use the “(*)” and “(*)” delimiters.

Tail remarks (-- text) shall be used to indicate the source of a schema that is specified in an interface statement.

EXAMPLE 2 The following example illustrates the use of tail remarks in interface statements:

```
USE FROM schema1 (e1, e2); -- ISO sssss-ppp
```

Tail remarks may also be used to annotate portions of the code of an EXPRESS PROCEDURE or FUNCTION. The functionality of algorithms may be explained by this method.

6.1.5 Indentation

Use indentation to achieve a consistent layout for EXPRESS declarations. In the requirements that follow, minimum requirements for indentation are stated; within one SC4 standard, the same indentation should be used.

6.1.6 Layout of a schema

The SCHEMA keyword is written flush with the left margin at the current indentation on a new line. The name of the schema follows the keyword, separated by a space. All declarations within a schema begin at the same margin.

EXAMPLE The following example illustrates the layout of schema, type, and entity data type declarations:

```
SCHEMA ...;  
  
TYPE ...;  
  
ENTITY ...;  
  
END_SCHEMA;
```

6.1.7 Layout of interface statements

If present, interface statements immediately follow the SCHEMA statement. The USE FROM ... or REFERENCE FROM ... keywords shall be aligned flush left without indentation. If the interface statement lists the interfaced entity data types, start the list on the line following the USE FROM ... or REFERENCE FROM ... statement. There shall be at least two spaces before the left parenthesis that precedes the list of interfaced entity data types. Use the same indentation for each list of interfaced entity data types. Place the identifier for each entity data type on a separate line. Indent the second and all subsequent entity data type names by three or more spaces, so that all names in the list are aligned. There shall be no spaces between the opening parenthesis and the first entity data type name in the list, between entity data type names and commas, or between the last entity data type name in the list and the closing parenthesis. Insert one blank line between each interface statement. If aliases are present and space on the line permits, spaces shall be used to align the AS keywords in tabular fashion.

EXAMPLE 1 The following example illustrates the layout of USE FROM interface statements:

```
USE FROM application_context_schema -- ISO 10303-41  
    (application_context,  
      application_protocol_definition);
```

EXAMPLE 2 The following example illustrates the layout of REFERENCE FROM interface statements:

```
REFERENCE FROM representation_schema - ISO 10303-43  
    (mapped_item,  
      representation,  
      representation_relationship);
```

6.1.8 Layout of a constant declaration

If present, a constant declarations shall follow the interface statements (or the SCHEMA statement, if there are no interface statements). Constant declarations may appear in a separate subclause or in the same subclause as type declarations. Colons within the constant declarations shall be aligned.

Use the following layout for constant declarations. The CONSTANT and END_CONSTANT keywords shall be flush to the left margin; the identifier of each declared constant shall be indented at least two spaces.

EXAMPLE The following example illustrates the layout of constraint declarations:

```

CONSTANT
  name1  : NUMBER := 1000;
  name21 : NUMBER := name1**2;
END_CONSTANT;

```

6.1.9 TYPE layout

Each defined type is declared within its own `TYPE ... END_TYPE` block. The `TYPE` and `END_TYPE` keywords shall be flush to the left margin. The type identifier shall follow the `TYPE` keyword, separated by a space. The `END_TYPE` keyword shall be written on a line by itself, aligned with the word `TYPE`. In the case of select or enumeration types, space shall be used to align the names in a tabular fashion with the same indentation as for interface statements (see 6.1.7).

EXAMPLE The following are examples of the format and layout of type declarations:

```

TYPE name = SET OF ent;
END_TYPE;

TYPE name = SELECT
  (ent1,
   ent2);
END_TYPE;

TYPE name = ENUMERATION OF
  (enum1,
   enum2);
END_TYPE;

```

6.1.10 Algorithm layout

The `RULE`, `FUNCTION`, or `PROCEDURE` keyword and the corresponding `END_RULE`, `END_FUNCTION`, or `END_PROCEDURE` keyword shall be flush to the left margin. The name of the algorithm follows the keyword, separated by a space.

Local declarations shall be written after the algorithm header and before any procedural code.

Use tail remarks (`-- <text>`) to explain the purpose of sections of procedural code. Use blank lines to separate logically related sections of code.

EXAMPLE The following example applies equally to rules, functions, and procedures except for the form of the keywords. Parameter lists, local declarations, and code body are dealt with separately.

```

PROCEDURE procedure_name(parameter_list);

  LOCAL
    local declarations
  END_LOCAL;

  -- explains following section
  code body

  -- explains following section
  code body

END_PROCEDURE;

```

6.1.11 Formal parameters

Formal parameters shall be grouped by type. A space shall follow a comma. Semicolons shall be treated according to 6.1.3 above; colons are treated according to 6.1.2 above except for the case of type labels where no space shall appear before or after the colon. There shall be no space between a function or procedure name and the following open parenthesis.

EXAMPLE 1 The following example illustrates the layout of formal parameters:

```
FUNCTION func_name(a, b, c : INTEGER;
                  d, e, f : REAL;
                  x, y, z : AGGREGATE OF point) : REAL;

PROCEDURE proc_name(a, b, c : INTEGER;
                   d, e, f : REAL;
                   VAR x, y, z : AGGREGATE OF point);
```

EXAMPLE 2 The following example illustrates a function with type labels:

```
FUNCTION add(a, b : GENERIC:label) : GENERIC:label;
```

The parameters of a rule list the entities to which the rule applies.

EXAMPLE 3 The following example illustrates the layout of the parameters of a rule.

```
RULE rule_name FOR (entity1, entity2, entity3);
```

If this does not fit on one line, follow the layout convention for type declarations.

6.1.12 Local variables

Local (variable) declarations shall be indented at least two spaces. Unlike attribute declarations, several local declarations that are of the same type may be declared on the same line.

EXAMPLE The following example illustrates the declaration of a number of local variables, some of the same type:

```
LOCAL
  i, j, k : INTEGER;
  p      : REAL
END_LOCAL;
```

6.1.13 Code body

A related group of statements shall be separated by one blank line from other groups of statements. A tail remark shall precede the statement group to explain its purpose. Structured statements shall be indented at least two spaces:

EXAMPLE The following example illustrates the layout of a code body:

```
IF cond THEN
  statement;
ELSE
  statement;
END_IF;
```

```

REPEAT ...;
    statement;
    ...
END_REPEAT;

-- Choose the appropriate case

CASE ...;
    label : statement;
    label :
    BEGIN
        statement;
        statement;
        ...
    END;
END_CASE;

BEGIN;
    statement;
    ...
END;

```

6.1.14 Entity data type declaration layout

The **ENTITY** keyword shall be written at the current margin on a new line. The identifier of the entity data type shall follow the keyword, separated by a space.

If present, the **SUPERTYPE** keyword shall start a new line indented at least two spaces from the **ENTITY** keyword. The first element of the supertype expression shall be written on the same line. Continuation lines, if required, shall be aligned with the first character following the opening parenthesis of the supertype expression. Additional elements shall be aligned with the first element. Note that compound elements (those enclosed within parentheses) should stay together on the same line, if possible. The supertype expression is written before the subtype expression.

If present, the **SUBTYPE** phrase shall start a new line indented at least two spaces from the **ENTITY** keyword. The first element of the subtype expression shall be written on the same line. Additional elements shall be aligned with the first element.

Explicit attributes shall be written one per line. The attribute name shall be indented two spaces. When there is more than one attribute, the colons shall be aligned.

If present, the **DERIVE** keyword shall be written on a line by itself and aligned with the **ENTITY** keyword. Derived attributes shall be written in the same manner as explicit attributes.

If present, the **UNIQUE** keyword shall be written on a line by itself and aligned with the **ENTITY** keyword. Each unique rule shall be written on a single line, if possible, and shall be labelled. Labels shall be indented at least two spaces. If a unique rule consists of more than one line, spaces shall be used to maintain an equal post-label indentation of the entire rule.

If present, the **WHERE** keyword shall be written on a line by itself and aligned with the **ENTITY** keyword. Each local domain rule shall be written on a single line, if possible, and shall be labelled. Labels shall be indented at least two spaces. If a local domain rule consists of more than one line, spaces shall be used to maintain an equal post-label indentation of the entire rule.

The **END_ENTITY** keyword shall be placed on a line by itself and aligned with the **ENTITY** keyword.

EXAMPLE The following example illustrates the layout and format of an entity data type declaration:

```

ENTITY entity_name
  SUPERTYPE OF (ONEOF(e1, e2)
                AND
                ONEOF(e3, e4));
  SUBTYPE OF (e5,
              e6);
  ea1      : ...;
  e_attrname2 : ...;
DERIVE
  d_attr3   : ...;
UNIQUE
  UR1: ea1;
  UR2: d_attr3, e_attrname2;
WHERE
  WR1: ea1 > 9;
  WR2: ODD(e_attrname2) OR
        e_attrname2 IN [ 2, 4, 8, 16, 32, 64, 128, 4096, 8192];

END_ENTITY;

```

6.2 Style rules

The style rules deal with capitalization and the choice and use of names for objects in a schema. Except for attribute names, EXPRESS identifiers shall be unique across all parts of ISO 10303.

NOTE The namespace for unique identifiers extends to parts of other SC4 standards that are deemed to be “common resources”.

6.2.1 Use of case

EXPRESS reserved words shall be written in upper case letters; everything else should be written in lower case. However, proper names are capitalized as in writing English (for example, Planck). Even though acronyms are usually written in capital letters, use lower case when writing in EXPRESS. In this way, anything that appears in lower case (or mixed case) is user-defined, and the definition can be sought elsewhere.

6.2.2 Names

An EXPRESS schema may use a large number of identifiers. Because names are very suggestive, clarity, avoidance of ambiguity, similarity, and uniqueness are important considerations in choosing an identifier name. The names chosen for EXPRESS elements should reflect the meaning of the element and should complement the natural language definition of the element. However, names should not be a substitute for a definition, or repeat the definition. Obviously, names should not conflict with or contradict the definition of the element.

The following general rules apply to naming of elements in an EXPRESS schema.

- Avoid confusion with similar names in the immediate context.
- Keep length down if possible. Do not use prefixes and suffixes such as `is_`, `a_`, `the_`, `_set`, `_array`, and `_list`.
- Use plural name forms for aggregates;
- Use nouns or non phrases for names of types, entity data types, and attributes;
- Use verbs or verb phrases for names of actions; and

— Separate name components by underscores.

6.2.2.1 SCHEMA names

Schema names in the ISO 10303 integrated resources shall end with “_schema”. Schema names in ISO 10303 application interpreted constructs shall begin with “aic_”.

6.2.2.2 Names of types

The name chosen for a type should reflect the nature of the type.

If the type defines a constraint on a base type the name should reflect the constraint.

EXAMPLE 1 A type whose base type is `INTEGER` and that constrains the domain to be even numbers is named “even_number”.

If the type is intended to add meaning to a base type the name should reflect the meaning.

EXAMPLE 2 A type whose base type is `STRING` and that is intended to be used to identify types of part is named “part_identifier”.

A select type should be named in terms of the role that the different members of the type can play.

EXAMPLE 3 A select type whose domain is the entity data types **person** and **organization** and indicates that a person or an organization can own something is named “owner”.

NOTE 1 The suffix “_select” may be included in the name of a select type if this helps to disambiguate the type from other EXPRESS elements in a given schema or collection of schemas.

NOTE 2 Particular conventions apply to the naming of select types that are used in completion of the management resource templates in ISO 10303-41. These select types are named by combining a word or phrase that stands for the administrative concept that is associated with product data and the suffix “_item”.

EXAMPLE 4 A select type whose domain is the set of entity data types with which an approval can be assigned is named “approval_item”.

The names used of an enumeration data type shall be distinct from the names of schemas, entity data types, and types. It is often appropriate for these to be adjectival, for example, planar rather than plane. However, different enumeration types may contain the same name.

6.2.2.3 Names of entity data types

The name chosen for an entity data type should reflect the class of “real world” objects or concepts that the entity data type represents. The name should make use of accepted terminology in the field supported by the schema in which the entity data type is defined.

NOTE This approach is not always feasible in generic schemas (such as the ISO 10303 integrated resources) that are intended to support a wide range of fields. In this case it is important to choose names that are neutral with respect to the possible applications of the entity data type, and to provide a definition that accurately convey the generic meaning of the entity data type.

Do not prefix entity data type names with definite or indefinite articles “the_” or “a_”.

EXAMPLE 1 An entity data type that represents documents should be named “document”, not “the_document” or “a_document”.

Entity data type names should be singular, not plural.

EXAMPLE 2 An entity data type that represents documents should be named “document”, not “documents”.

The name of an entity data type may reflect the name of other entity data types to which it is related in a subtype/supertype hierarchy. The name may reflect:

- how a subtype differs from its supertype;
- how one subtype differs from other subtypes (of a common supertype).

In an ISO 10303 integrated resource, the name of a subtype should reflect the specialized meaning or intended usage of the subtype.

EXAMPLE 3 ISO 10303-41 define an entity data type named **product_definition_relationship** that represents associations between instances of the **product_definition** entity data type. A subtype of **product_definition_relationship** defined in ISO 10303-44 specializes its meaning such that one of the related instances of **product_definition** represents a component in an assembly that is represented by the other instance of **product_definition**. The name of this subtype is **assembly_component_usage**.

In the application interpreted model of an ISO 10303 application protocol, the name of a subtype of an entity data type defined in the integrated resources may reflect the usage of the resource construct in the application protocol.

Do not use the schema name as the prefix to an entity data type name: entity data type **unit** of schema **x** is referred to as **x.unit** from another schema. However, it is sometimes necessary to use the name of a supertype as a suffix for subtype entity data types.

EXAMPLE 4 The suffixes “_curve” and “_surface” are necessary in the entity data type names **b_spline_curve** and **b_spline_surface** because “b_spline” alone would cause a name clash.

In a like manner, the name of a supertype sometimes is useful as a prefix to a subtype name.

EXAMPLE 5 The supertype name is used as a prefix in the name of the entity data type **surface_of_revolution**.

6.2.2.4 Names of attributes

The name chosen for an attribute should reflect the role that the domain of the referenced type plays in the entity data type in which the attribute is declared. Use singular names for single-valued attributes. Use a plural name for an attribute whose domain is an aggregate.

Do not use the entity data type name as a prefix of an attribute name. Attribute **test** of entity **x** is referred to as **x.test** from outside scope of that entity data type.

Do not append “_set”, “_array”, “_bag”, or “_list” to an attribute type.

EXAMPLE Use “knots” instead of “knot_array”.

Do not use the type name as the attribute name even though EXPRESS allows it. The attribute name should reflect the role the type is playing in the definition of the entity data type.

6.2.2.5 Names of rules, functions, and procedures

When choosing a name, the use that will be read most often takes priority. For example, the executable code of a function will not be reviewed very often, but the function name will be. Consequently, the name should read naturally in a domain (WHERE) rule rather than following the keyword

FUNCTION. The choice does not depend on which happens to be written first: the one containing its use or its declaration. For the purposes of choosing a name, the use takes precedence.

For example, rather than using:

```
FUNCTION is_extension_supplied ()
```

whose invocation would be:

```
IF is_extension_supplied ( ) THEN
```

the “is_” prefix should be removed, allowing the call to be read as a phrase in English as well as in EXPRESS. In this case, the function declaration should be:

```
FUNCTION extension_supplied ()
```

so that its invocation is:

```
IF extension_supplied ( ) THEN
```

6.2.2.6 Clashes of attribute and function names

Attributes shall not have the same names as functions; such name conflicts are confusing in domain rules.

6.2.2.7 Clashes of entity data type names and enumeration values

Entity data types shall not have the same name as enumeration type values; such name conflicts are illegal according to ISO 10303-11.

6.2.2.8 Length of names

Although EXPRESS schemas are published as digital files the documentation of the schema shall conform to publishing requirements based on the rules and guidelines for page size and fonts specified in this document (see 5.1). In order to avoid line breaks in EXPRESS identifiers, there is a practical limit of 60 characters on the names used for EXPRESS elements. Although such long names should be avoided, conventions for naming of entity data types and rules can produce names that exceed this limit. In this case abbreviations may be used.

EXAMPLE 1 Some SC4 projects use a convention for naming rules that combines the name of the entity data type that is constrained by the rule with a phrase that describes the constraint applied. This can lead to very long names, such as “product_definition_relationship_requires_primary_classification” (63 characters). To avoid such long names, identifiers of constrained entity data types name be abbreviated as they are used in rules. In this case, the name “pdr_requires_primary_classification” could be used.

If this approach is adopted, then the following requirements apply:

- the abbreviation shall be used consistently;

EXAMPLE 2 In the example above, all rules in the schema that constrain the product_definition_relationship entity data type should be prefixed “pdr_”, not just those whose unabbreviated names would exceed 60 characters.

- the abbreviations shall be defined and their use explained at the start of the clause or subclause in which the schema is defined.

To define and explain the use of the abbreviated names, use the following text.

[SC4 required]

Abbreviated names are used in the identifiers of the <entity data types, rules, ...> declared in this schema. Prefixes used in these identifiers have the following meanings:

<list the abbreviated forms and the full names>

[end required]

EXAMPLE 3 The following example illustrates the use of this text:

Abbreviated names are used in the identifiers of the rules declared in this schema. Prefixes used in these identifiers have the following meanings:

```
cgs      character_glyph_symbol
pdr      product_definition_relationship
pdu      product_definition_usage
```

6.2.2.9 Abbreviations and acronyms

Abbreviations and acronyms can be confusing. Avoid them if possible. When they must be used (to avoid layout problems), care shall be taken to use them consistently and to document the full meaning. When an abbreviation or acronym is used, a comment shall be provided to give the full spelling.

6.3 EXPRESS usage style requirements

6.3.1 Use of local domain (WHERE) rules

WHERE rules are used for at least three different purposes:

- To state aspects of the definition of an entity data type in a formal manner. Typically these are tests that will be true by definition, whatever the attribute values are.
- To define the desired behaviour of the entity with respect to certain known queries.
- To define tests that can be applied to an instance of the entity to ensure that it is a valid instance.

EXAMPLE The following contains one of each of these uses (in the same order):

```
ENTITY line;
  start : point;
  dir   : direction;
WHERE
  WR1: arc_length_extent(line) = infinity;
  WR2: coordinate_space(line) = coordinate_space(start);
  WR3: start.x > 0.0;
END_ENTITY;
```

Of these three, only the third shall be used. The first WHERE rule should be added to the definition of the entity data type while the second class should either be treated using derived attributes or left until a future version of EXPRESS provides a clearer means of establishing the behavioural characteristics of entity implementations.

Large functions that test several aspects of an entity should not be used. Split the function into several smaller functions.

6.3.2 Labelling UNIQUE and WHERE rules

All UNIQUE rules shall have a label that is unique within the scope of all labels used within the entity data type. Unless an appropriate short English word can be used, the form of the label shall be URn where n is an integer giving the position of the rule in the list.

NOTE 1 By convention, schemas defined in parts of ISO 10303 use the URn form only.

All WHERE rules shall have a label that is unique within the scope of all labels used within the entity. Unless an appropriate short English word can be used, the form of the label shall be WRn where n is an integer giving the position of the rule in the list.

NOTE 2 By convention, schemas defined in parts of ISO 10303 use the WRn form only.

6.3.3 Definition of constraints

An entity data type can be constrained by any of the following three methods:

- definition of the entity data type;
- formal proposition: a computable constraint written in EXPRESS;
- informal proposition: constraints that cannot be documented formally.

The constraints expressed in the definition of the entity data type, in the formal propositions, and in the informal propositions shall not be redundant. There shall be as little overlap as possible between the restrictions placed on the entity data type among these three types of constraints.

Any characteristics of the entity data type that are part of its definition and are unaffected by attribute values are true at all times and do not need to be reiterated in the constraints and propositions.

6.4 EXPRESS schema documentation

NOTE In the previous edition of the Supplementary Directives these documentation requirements were defined only for ISO 10303 integrated resources. These requirements in fact apply to all SC4 standards that define EXPRESS schemas. Any of the requirements below that only apply to integrated resources are indicated as such.

6.4.1 General requirements

The title of each clause or subclause in which a schema is declared shall be the schema name (without the “_schema” suffix, if this is part of the name), with underscores replaced by spaces, and with the initial character in upper case.

For parts of ISO 10303 that are in the integrated resources series, each schema shall be documented in a separate clause.

When referring to the elements of the EXPRESS language, EXPRESS reserved words (such as SCHEMA, ENTITY, WHERE) shall appear as all caps in a monospaced font (see Table 3 in 5.1.3).

NOTE 1 Such references in the documentation of a schema should not be necessary, as these words refer to the elements of the language itself.

When referring to elements of the schema, words and phrases such as “type”, “schema”, and “entity data type” shall not be capitalized.

EXAMPLE In text that refers to an entity data type, use the phrase “the <entity data type name> entity data type, not “the <entity data type name> ENTITY”.

In the documentation of a schema, the same English language words may be used to refer to an object in the real world or to a concept, and as the name of an EXPRESS data type that represents this object or concept. Use the following typographical convention to distinguish between these. If the referent is the object or concept, the word or phrase occurs in the same typeface as narrative text. If the referent is the EXPRESS data type, the word or phrase occurs in a bold typeface. Use bold typeface for the names of EXPRESS schemas, functions, rules, procedures, and attributes of entity data types where they appear in general text.

The name of an EXPRESS data type may be used to refer to the data type itself, or to an instance of the data type. The distinction between these uses is normally clear from the context. If there is a likelihood of ambiguity, the phrase “entity data type” or “instance(s) of” is included in the text.

NOTE See the SC4 Quality manual [24], 6.1, for the procedure for validation of EXPRESS schemas.

6.4.2 Components of a clause that specifies an EXPRESS schema

Each clause that specifies an EXPRESS schema shall contain the following subclauses in the order given below:

- x <schema name>
- x.1 Introduction
- x.2 Fundamental concepts and assumptions
- x.3 <schema name> type definitions
- x.4 <schema name> entity data type definitions
- x.5 <schema name> rule definitions
- x.6 <schema name> function definitions

If there is nothing contained in one of the subclauses, the subclause shall be omitted and the remaining subclauses renumbered accordingly.

The subclause containing declarations of entity data types may also be titled “<schema name> entity definitions”. If this form is used it shall be used consistently for all schemas defined in one part.

6.4.3 Schema documentation requirements

The following rules shall apply to documenting the schema.

The schema clause shall be introduced with the following wording:

[SC4 required]

The following EXPRESS declaration begins the <schema name> and identifies the necessary external references.

[end required]

The <schema name> should be replaced by the name of the schema as it appears in the schema declaration. This wording shall appear immediately following the clause heading. If there are no external references, the words “and identifies the necessary external references” shall be omitted.

The above text shall be followed by the schema declaration. The declaration shall include any interface statements (USE FROM or REFERENCE FROM) necessary for the schema. The declaration shall be of the form:

[SC4 required]

EXPRESS specification:

```
* )
SCHEMA <schema_1 name>;

REFERENCE FROM <schema_2 name>
  (<e1 name,
   e2 name>);
(*
```

[end required]

Where interface statements occur, place a note following the schema declaration that identifies the source(s) of the interfaced schema(s). These sources may be any of the following:

- another clause of the same part;
- another part of the same SC4 standard;
- a different standard.

In the second and third cases the standard in which the interfaced schema is declared shall be listed as a normative reference (see 4.2.4).

The note shall be of the following form:

[SC4 required]

NOTE The schemas referenced above can be found in the following <source documents>:

```
<schema_1>    Clause <n> of this part of <ISO number>

<schema_2>    ISO <ISO standard and part number>
```

[end required]

Replace <source documents> by one of the following:

- if the referenced parts are all parts of the same International Standard, use “parts of ISO <ISO number>”;
- if the referenced parts are from more than one International Standard, use either “parts of ISO <ISO number 1>, ISO <ISO number 2>, ...” or “standards”.

In the first case, if the part containing the schema being defined and the parts that defined the interfaced schema are all parts of the same International Standard, then “parts of this International Standard” may be used.

The elements of the note are arranged in two left-justified columns, without punctuation. The schema name shall be presented in bold face.

6.4.4 Introduction to schema

The introduction to the schema shall include the objectives of the schema and a description of its major components and key concepts.

This subclause is primarily text but may contain figures, such as an EXPRESS-G that presents an overview of the entity data types contained in the schema. If included, this figure shall be referenced from a note.

For schemas defined in integrated resources parts of ISO 10303, use the following wording to begin the introduction to each schema:

[ISO 10303 required]

The subject of the <schema name> is

[end required]

6.4.5 Fundamental concepts and assumptions

The fundamental concepts and assumptions are declarations of fact about the subject area of the schema. These facts have been used as the basis for developing the integrated resource and are essential to the reader understanding and using the part.

Fundamental concepts and assumptions may be expressed in a general or structured form. The general form shall be text that describes the concepts and assumptions that underlie the schema. The structured form shall be a list formatted as described in 4.5.

Fundamental concepts that apply to the entire part covering multiple schemas shall be documented in an additional clause immediately following the terms and abbreviations clause. Extra clauses may be included if appropriate to precede collections of related schemas.

6.4.6 Documentation of formal propositions

Formal propositions follow the EXPRESS declaration (types and entity data types), the definition of enumeration items (types only), or argument definitions (rules). Formal propositions are constraints that are computable, are written in EXPRESS, and are placed within the *WHERE* clause of the declaration of a type, entity data type, or rule. The following rules apply to formal propositions in the documentation of types (see 6.4.8), entity data types (see 6.4.9), or rules (see 6.4.10).

- The formal propositions shall be preceded by the underlined title “Formal propositions:”.

- When there is a local rule label in the EXPRESS specification, each formal proposition shall start with the local rule label and be followed immediately by a colon and a single space. The label shall be in boldface. The colon shall not be boldface.

EXAMPLE The following examples illustrate the layout and format of formal propositions:

WR1: The value of x shall be positive.

UR1: The name shall be unique.

- The ISO required verb forms (for example, “shall” or “should” – see 4.8) shall be used. “Must” shall not be used.
- Any additional explanation or examples shall be provided as notes (see 4.4.3) or examples (see 4.4.4).
- The order of the formal propositions shall be the same as the order of the constraint specifications in the EXPRESS declarations.
- There shall be a one-to-one correspondence between the local rules stated in the EXPRESS declaration (WHERE, INVERSE, and UNIQUE constraints) and the elements in the list of formal propositions.
- If a local rule uses a call to an EXPRESS function, the effect of the tests within that function as they are applied to this type or entity data type shall be briefly described. A statement that the function shall return true is not adequate. A local rule is satisfied if the evaluated result of the rule expression is TRUE or UNKNOWN; a function used within a local rule may never return UNKNOWN.

6.4.7 Documentation of informal propositions

Informal propositions are un-computable constraints that cannot, or cannot reasonably, be written in EXPRESS, although each informal proposition still represents a requirement. If an EXPRESS declaration exists or EXPRESS-like pseudo-code has been written, it may be included in an informative annex as a technical discussion. Each informal proposition shall be presented as follows.

- The informal propositions shall be preceded by the underlined title “Informal propositions:”.
- Each informal proposition shall be given a label, corresponding to the local rule labels that appear in formal propositions. By convention, informal propositions in ISO 10303 parts are labelled IP1, IP2, and so on.
- The ISO required verb forms (for example, “shall” or “should” – see 4.8) shall be used. “Must” shall not be used.
- Any additional explanation or examples shall be provided as notes (see 4.4.3) or examples (see 4.4.4).

The explanation for each information proposition shall state the conditions and requirements that shall be met by instances of the type or the entity data type.

6.4.8 Type documentation requirements

The following rules apply to the documentation of types.

- Document each type in the “<schema name> type definitions” subclause in a separate subclause. The title of the subclause shall be the name of the type exactly as it appears in the EXPRESS declaration (lower case with underscores).
- The title shall be followed by a textual definition of the type and any supporting material necessary to define the intent of the type. In particular, this text should demonstrate how this type is different from any other similar type.
- The EXPRESS declaration shall be given next using the format described in 6.1.9, separated from the text by comment markers as described in 6.1.4. The title “EXPRESS specification.” shall be placed immediately before the close-comment marker.
- If the type is an enumeration of items, the items may be defined following the EXPRESS declaration. Definitions of enumerated items shall be given for clarity, unless the definition is given in the “Definition clause”. If the definition is given in the “Definition clause”, the reference should be included as a note. The title “Enumerated item definitions.” shall precede the definitions of the enumeration items. Each enumerated item definition shall consist of the identifier of the item in boldface, a colon, one space, and the definition of the item.
- Formal propositions (see 6.4.6) follow the EXPRESS declaration or the definition of enumeration items.
- Informal propositions (see 6.4.7) follow the formal propositions

6.4.9 Entity data type documentation

6.4.9.1 General requirements

The entity data types declared in a schema shall be documented in a subclause titled ““<schema name> entity data type definitions” or “<schema name> entity definitions”. Entity data types may be collected into logical groups in order to enhance the readability and understandability of the schema. If such groups are used (there shall be at least two such groups), the following structure should be used for the entity definition subclause.

x.y.1 <schema name> entity data type definitions: <logical group name 1>

x.y.2 <schema name> entity data type definitions: <logical group name 2>

x.y.3 <schema name> entity data type definitions: <logical group name 3>

...

x.y.n <schema name> entity data type definitions: <logical group name n>

All EXPRESS entity data types shall be at the same subclause level within each group.

All EXPRESS entity data types within a given functional grouping should be presented in an order that will aid understanding. An obvious and common ordering will present the EXPRESS entity data types according to the subtype/supertype hierarchy relationships among the entity data types.

If there is no other reasonable order, the entities shall appear in alphabetical order.

6.4.9.2 Documenting a single entity data type

NOTE 1 See C.3 for an example of the documentation of an entity data type.

The following rules apply to documenting an entity data type.

- Each entity data type definition shall be a new subclause. The title of the subclause shall be the name of the entity data type exactly as it appears in the EXPRESS declaration (lower case with underscores). See 6.2.2.3 for the requirements that apply to naming of entity data types.
- The definition of an entity data type shall state clearly the following:
 - the concept that the entity data type represents;
 - the information about the concept that is represented in the data structure and constraints defined by the entity data type.

The name of the entity data type without underscore and in normal text (not boldface) may be used to stand for the concept that the entity data type represents.

- The follow convention may be used to simplify entity data type definitions. The phrase “an **<entity_data_type_name>** is/represents ...” may be used as a short hand for “An instance of the **<entity_data_type_name>** entity data type is/represents ...”.

If this convention is used it shall be used consistently for all entity data type definitions in the standard; the convention itself shall be described in the introduction of the standard.

- Examples may be provided to clarify the concept that is represented by the entity data type or to illustrate the population of entity data type and its attributes. It shall be clear whether each example refers to the concept represented by the entity data type or the data that is governed by the entity data type. Examples follow the prose definition.
- Extra explanations and references to other sources for explanations should be given as one or more notes.
- Tables or figures may be included in the definition of an entity data type. If the information conveyed in the table or figure is essential to understanding of the entity data type, the table or figure shall be referenced from the normative text of the definition so that it is itself normative. If the information conveyed in the table or figure enhances but it not essential to understanding of the entity data type, the table or figure shall be referenced from a suitable note or example so that it is itself informative.

The EXPRESS declaration for the entity data type follows the definition. The declaration shall be introduced by the underlined title “EXPRESS specification:” and delimited by comment markers as specified in 6.1.4.

Following the EXPRESS declaration, all attributes (both explicit and derived) shall be documented. The attribute definitions shall be introduced by the underlined title “Attribute definitions:”. The following rules apply to the documentation of attribute definitions:

- The attributes shall be documented in the same order as they appear in the EXPRESS declaration.
- The attribute definitions shall be presented as follows.
 - Each attribute definition shall start with the attribute name exactly as given in the EXPRESS declaration (complete with underscores), in boldface, followed by a colon.
 - The definition of the attribute shall follow the name of the attribute, starting on the same line.

- The definition of the attribute shall describe the role of that attribute in the entity data type. If the attribute uses another entity data type or type, there is no need to give a definition for the referenced item.

NOTE 2 If it appears necessary to redefine the referenced item, indicating that meaning of the referenced type varies according to its use, consider defining a new intersection entity data type.

- Additional explanation may be given as notes.
- Examples that illustrate the population or usage of the attribute may also be given.

Formal propositions (see 6.4.6) follow the attribute definitions. Formal propositions shall only be included where the result of the evaluation depends on the values of the attributes, the complex type of instances, or both. If the formal proposition always returns true, it shall not be included as a formal proposition but rather should be included as part of the definition of the entity data type.

Informal propositions (see 6.4.7) follow the formal propositions.

6.4.9.3 References to attributes declared in supertypes

A reference to an attribute declared in a supertype may be explained with a note following the first use of the attribute name.

EXAMPLE The following example illustrates the wording of such a note:

NOTE The attribute <a_name> is declared in the <e_name> entity data type of which this entity data type is a subtype.

Phrases that reflect particular implementation considerations, such as “inherited attribute”, should not be used.

6.4.9.4 Plurals of

Avoid using plurals of EXPRESS object names by an alternate usage, such as “several instances of the **vertex** entity data type.” If necessary, plurals of EXPRESS object names may be made by adding an “s” (not in boldface) to the end of the name. This includes names for which the plural in English changes the spelling of the word.

EXAMPLE The following example illustrates the addition of an “s” to refer to multiple instances of the vertex entity data type: “An **open_path** visits its **vertexs** exactly once.”.

NOTE The wording specified in the example above is much clearer if changed to: “Each instance of **open_path** visits each of its instances of **vertex** exactly once.”.

6.4.10 Rule documentation requirements

The following rules shall apply to documenting rules.

- All rules shall be declared/defined in the “<schema name> rule definitions” subclause.
- Each rule shall constitute a new subclause. The title shall be the name of the rule exactly as it appears in the EXPRESS declaration (lower case with underscores). This name should not be abbreviated and should comprise, where possible, proper English words (see 6.2.2.8 for constraints on the maximum length of EXPRESS identifiers).

- If there is only one rule declaration in a schema, the rule declaration shall appear in a single subclause titled “<schema name> rule definition: <rule name>”.
- The title shall be followed by a prose definition and any supporting text necessary to state the intent of the rule.
- The EXPRESS declaration shall follow the definition, preceded by the underlined title “EXPRESS specification”.
- The arguments of the rule shall be defined following the EXPRESS declaration, preceded by the underlined title “Argument definitions”.
- The argument definitions shall be presented as follows.
 - Each argument definition shall start with the argument name exactly as given in the EXPRESS declaration (complete with underscores), in boldface, followed by a colon.
 - The definition of the argument shall follow the name of the argument, starting on the same line.
- Each constraint within the WHERE clause of the rule shall have a unique label. Unless an appropriate short English word can be used, the form of the label shall be WRn where n is an integer giving the position of the rule in the list.

NOTE By convention, schemas defined in parts of ISO 10303 use the WRn form only.

- Each constraint within the WHERE clause of the rule shall be documented as a formal proposition (see 6.4.6). The formal propositions follow the argument definitions.
- If a constraint is dependent on an unelaborated function or procedure (see 6.4.11.3), this should be stated in a note.

EXAMPLE The following example illustrates the wording of a such a note.

NOTE This rule is based on an unelaborated EXPRESS function.

6.4.11 Function (procedure) documentation requirements

6.4.11.1 General requirements

The following rules shall apply to documenting function (or procedure) definitions:

- All functions shall be declared/defined in the “<schema name> function definitions” subclause.
- Each function shall constitute a new subclause. The title shall be the name of the function exactly as it appears in the EXPRESS declaration (lower case with underscores). The name should not be abbreviated and should comprise, where possible, proper English words (see 6.2.2.8 for constraints on the maximum length of EXPRESS identifiers).
- If there is only one function declaration in a schema, it should appear in a single subclause titled “<schema name> function definition: “<function name>”.
- The title shall be followed by a definition and any supporting text necessary to define the intent of the function.

- EXPRESS declaration shall follow the definition, preceded by the underlined title “EXPRESS specification:”.
- The arguments of the function shall be defined following the EXPRESS declaration, preceded by the underlined title “Argument definitions:”.
- The argument definitions shall be presented as follows.
 - Each argument definition shall start with the argument name exactly as given in the EXPRESS declaration (complete with underscores), in boldface, followed by a colon.
 - The definition of the argument shall follow the name of the argument, starting on the same line. Each definition shall include whether the argument is an input, output, or both, and enumerate and define any error conditions that may result from the function.

EXPRESS functions and procedures and their application to entities may be documented by three different methods according to the completeness of the specification included in the part. These methods are as follows:

- Functions and procedures that are fully specified in EXPRESS (see 6.4.11.2).
- Functions and procedures that cannot, or cannot easily, be specified in EXPRESS but can be implemented within a specific application system (see 6.4.11.3).
- Functions or procedures that cannot be implemented at all, either within EXPRESS or within an application system (see 6.4.11.4).

When the EXPRESS declaration of a function is not or cannot be explicitly specified, an EXPRESS comment should replace the body of the function stating the following:

- why the appropriate EXPRESS language statements are missing;
- what the function is intended to do.

6.4.11.2 Functions and procedures fully specified in EXPRESS

Functions and procedures fully specified in EXPRESS shall be documented as follows.

- The full EXPRESS specification of the function or procedure shall be documented in an appropriate subclause.
- The function or procedure shall be used as part of the definition of a constraint in one or more types or entity data types.

EXAMPLE 1 The following example illustrates a fragment of the EXPRESS declaration for a fully specified function:

```
*)
FUNCTION function_name (x:INTEGER): LOGICAL;

<function body in EXPRESS>

END_FUNCTION;
( *
```

EXAMPLE 2 The following example illustrates a fragment of the EXPRESS declaration of an entity data type that uses the function illustrated above to define a constraint:

```
*)
ENTITY foo;
...
WHERE
  WR1: function_name(...);
END_ENTITY;
(*
...

```

Formal propositions:

```
WR1: xxx;
```

6.4.11.3 Functions and procedures that can be implemented within a specific application system

Functions and procedures that cannot, or cannot easily, be implemented in EXPRESS but can be implemented within a specific application system, shall be documented as follows:

- The EXPRESS specification of the function or procedure shall include the phrase “unelaborated function/procedure” as a tail remark together with text describing the intent of the function.
- The function or procedure shall be used as part of the definition of a constraint in one or more types or entity data types.

EXAMPLE 1 The following example illustrates a fragment of the EXPRESS declaration for an unelaborated function:

```
*)
FUNCTION function_name (x:INTEGER): LOGICAL;

-- unelaborated function

(* <text that explains the intent of the function. Note that the text is
commented out between the function head and tail.> *)

END_FUNCTION;
(*

```

The tail comment shall be inserted as shown so that it will occur in the EXPRESS listing of the schema (see 7.5.2.1 for ISO 10303 integrated resources, 8.4 for ISO 10303 application interpreted constructs, and 9.9.1.1 and 9.9.2.4 for ISO 10303 application protocols).

An explanation of why the function is not elaborated may be placed in a note following the textual description of the function.

EXAMPLE 2 The following example illustrates a fragment of the EXPRESS declaration of an entity data type that uses the function illustrated above to define a constraint:

```
*)
ENTITY foo;
...
WHERE
```

```

    WR1: function_name(...);
END_ENTITY;
(*

```

```

...

```

Formal propositions:

```

WR1: xxx;

```

NOTE This proposition is based upon an unelaborated EXPRESS function or procedure.

The note following the formal proposition shall be included to indicate that an EXPRESS declaration for the function exists, but that it has not been elaborated.

6.4.11.4 Constraints that cannot be implemented

Not all constraints can be implemented in a uniform manner, either within EXPRESS or within an application system.

Such constraints shall be documented as follows:

- If the constraint applies to a single entity data type, it shall be defined in an informal proposition (see 6.4.7) within the documentation of that entity data type.
- If the constraint applies to two or more entity data types, it shall be defined as a pseudo-function, in a separate subclause. However, no EXPRESS declaration shall be given.

6.4.12 End of schema declaration

The EXPRESS declaration shall be the last item of the last subclause within each schema clause:

```

*)
END_SCHEMA;  -- <schema name>
(*

```

6.5 EXPRESS-G diagram style

Each EXPRESS-G diagram shall follow the format in annex D of ISO 10303-11 with additional rules listed below.

NOTE 1 See 5.1.3 for requirements that apply to the fonts and font sizes used in EXPRESS-G diagrams.

NOTE 2 See 5.3.3 for general requirements to the format and layout of figures.

- If possible, each schema shall occupy one page. A schema may occupy more than one page, if necessary, and two schemas may occupy a single page if each fits onto one-half page.
- There shall be no boxes around EXPRESS-G diagrams.
- All entity data types declared in the schema shall be included.
- All select, enumeration, and defined types shall be included.
- Inter-schema references shall be included for all interfaced entity data types.

- The abbreviations L, S, B, and A shall be used for aggregate types of attributes and types shall be indicated to indicate list, set, bag, and array respectively.
- Cardinality of attributes and types shall be indicated when appropriate by appending the bound specification to the aggregate abbreviation.
- Inverse and derived attributes shall be included in the EXPRESS-G diagrams and indicated by “(INV)” and “(DER)” respectively.
- The “to” end of an emphasized direction of a relationship shall be indicated by an open circle. The relationship line shall not enter the circle.
- Each attributes whose domain is a simple data types (BINARY, BOOLEAN, LOGICAL, STRING, NUMBER, INTEGER, or REAL) shall not show the simple data type but instead shall terminate with the same open circle as used for emphasized direction.
- In ISO 10303, each attribute whose domain is one of the defined types **identifier**, **label**, or **text** shall not show the defined type but instead shall terminate with the same open circle as used for emphasized direction.

NOTE 3 The types **identifier**, **label**, and **text** are defined in the support_resources_schema in ISO 10303-41.

- The weight (thickness or width) of lines forming the symbols used for entity data types, select types, defined types, enumeration types, base types, schema references, and off-page connectors shall be approximately 1mm.
- The thickness of a SUPERTYPE relationship line shall be at least twice that of the attribute relationship lines.
- All dashed lines shall be comprised of lines and gaps with a “unit” length between 2mm and 4 mm.
- All relationship lines shall be oriented either vertically or horizontally (no diagonal lines or curves).

7 Documentation of integrated resources series of parts of ISO 10303

This clause gives rules and guidelines specific to documenting the integrated resources series of parts of ISO 10303. Each part of ISO 10303 that is a member of the integrated resources series defines integrated resource constructs with a different scope and shall be published separately. The general requirements for SC4 standards specified in clauses 4 and 5 apply to the integrated resources series of parts of ISO 10303. Specific requirements for this series are described in this clause.

An outline for the contents of an integrated resource part is shown in Table 8.

Table 8 — Contents of an integrated resource part

Foreword^a

Introduction^a

1 Scope

2 Normative references

3 Definitions

4 <ir schema 1 name>

4.1 Introduction

4.2 Fundamental concepts and assumptions

4.2 <ir schema 1 name> type definitions

4.3 <ir schema 1 name> entity definitions

4.4 <ir schema 1 name> function definitions

4.5 <ir schema 1 name> rule definitions

5 <ir schema 2 name>^b

...

Annex A (normative) Short names of entities

Annex B (normative) Information object registration

B.1 Document identification

B.2 Schema identification

Annex C (informative) Computer interpretable listings

Annex D (informative) EXPRESS-G diagrams

Annex E (informative) Technical discussions^c

Annex F (informative) Examples^c

Bibliography^c

Index

Table 8 — Contents of an integrated resource part (concluded)

- ^a Do not list these elements in the table of contents.
- ^b Include one clause for each schema included in the part.
- ^c These annexes or elements of the standard are optional and informative. Annexes shall be labelled in alphabetical order. If any of the optional annexes are omitted, adjust the labelling accordingly.

7.1 Documentation of scope

The scope clause of a part of ISO 10303 in the integrated resources series provides a clear explanation of the technical boundaries addressed by the schemas specified in the part. For an integrated generic resource part, this describes the domain of applicability. For an integrated application resource part, this describes the application area.

See 4.2.3 for general requirements for the wording of the scope clause. Use the following wording to introduce the scope clause of a part of ISO 10303 that is a member of the integrated resources series:

[ISO 10303 required]

This part of ISO 10303 specifies the resource constructs for ...

[end required]

The primary mechanism for defining the scope of each part in the integrated resources series is a simple text explanation of the information content of the part. At the minimum, an integrated resource part shall contain a narrative description of the scope of the information represented by the schema. It should describe the application area being addressed and any boundaries, limits, or rules used to determine whether something is in scope.

7.2 Documentation of normative references

Each part of ISO 10303 that is related to the integrated resource constructs being documented shall be identified as a normative reference. A part of ISO 10303 containing a schema that is identified by a `USE FROM EXPRESS` statement in the integrated resource being documented is related and shall be listed as a normative reference.

7.3 Documentation of terms, definitions, symbols, and abbreviations

The terms defined in this clause shall be those that are specific to the application area or domain defined by the scope. See 4.2.4.5 and 5.4.5 for general requirements that apply to this clause.

7.4 Documentation of requirements

Each part of ISO 10303 in the integrated resources series includes a clause for each schema that is documented in the part. See clause 6 for requirements that apply to the documentation of `EXPRESS` schemas.

7.5 Documentation of annexes

The following subclauses describe the normative annexes that are part of an integrated resource and the informative annexes that shall and may be included.

7.5.1 Normative annexes

There are two normative annexes required for parts of ISO 10303 in the integrated resources series:

- Short names of entities (annex A)
- Information object registration (annex B)

7.5.1.1 Short names of entities (annex A)

Annex A shall contain a table of the correspondence between the entity data type names defined in the part with the short form of these names. The title of this annex shall be “Short names of entities”. The table shall be given in two, left-justified columns, unbolded, with appropriate capitalization. The first column shall contain the long names (as given in the main body of the part) in alphabetical order, and the second column shall contain the short names.

NOTE The requirements described here also apply to the corresponding annexes of ISO 10303 application interpreted constructs (see 8.5.1.1) and ISO 10303 application protocols (see 9.9.1.2).

Use the following text and format to document short names. See 5.3.4 for general rules that apply to tables.

[ISO 10303 required]

Table A.1 provides the short names of entities specified in this part of ISO 10303. Requirements on the use of the short names are found in the implementation methods included in ISO 10303.

[end required]

Use the example below as a model for the table of short names.

EXAMPLE The example below illustrates the required layout of the short names table.

Table A.1 — Short names of entities	
Entity data types names	Short names
first_entity_data_type	FRENDTTP
second_entity_data_type	SCENDTTP
...	
last_entity_data_type	LSENDTTP

Project teams are responsible for generating the short names listed in this annex. An on-line facility for generating and managing unique short names⁵⁾ is available at:

http://www.steptools.com/short_names/index.html

7.5.1.2 Information object registration (annex B)

Each ISO 10303 integrated resource shall contain an information object registration annex that specifies its document identification and the schema identification for each EXPRESS schema specified in the part. See annex B of these Supplementary Directives for the requirements that apply to information object registration annexes.

7.5.2 Required informative annexes

The following informative annexes are required for integrated resources:

7.5.2.1 Computer interpretable listings annex (annex C)

Annex C shall provide electronic access to the list of short names provided in annex A and the EXPRESS specified in this part. This access is provided through the specification of URLs that identify the location of these files on the Internet. The EXPRESS file shall not contain any intervening prose; the EXPRESS listing for all schemas shall be found in one file. The listing shall not contain any comment delimiters of the kind “*”)” and “(*” that separate the EXPRESS declarations from the main body of the prose. However, tail comments (those beginning with “--”) may be included.

Use the following text and format for documenting this annex. In the URL for the EXPRESS, replace “nnn” in “partnnn” with the number of this part of ISO 10303 and “is” with the stage of the part. Confirm the URL with the SC4 Secretariat prior to publication.

[ISO 10303 required]

This annex references a listing of the EXPRESS entity data type names and corresponding short names as specified in this part of ISO 10303. It also references a listing of each EXPRESS schema specified in this part of ISO 10303, without comments or other explanatory text. These listings are available in computer-interpretable form and can be found at the following URLs:

Short names:

<http://www.mel.nist.gov/div826/subject/apde/snr/>

EXPRESS:

<http://www.mel.nist.gov/step/parts/partnnn/is/>

If there is difficulty accessing these sites contact ISO Central Secretariat or contact the ISO TC 184/SC4 Secretariat directly at sc4sec@cme.nist.gov.

NOTE The information provided in computer-interpretable form at the above URLs is informative. The information that is contained in the body of this part of ISO 10303 is normative.

[end required]

⁵⁾ This service was previously supported by the SC4 Secretariat/NIST as part of the Application Protocol Development Environment (APDE). STEP Tools, Inc. took over administration of this service in October 2000.

7.5.2.2 EXPRESS-G diagrams (annex D)

The EXPRESS-G diagrams describing the schema(s) defined in the part shall be included as a set of figures in annex D. Rules for formatting these diagrams are found in 6.5.

Use the following text to introduce the EXPRESS-G diagrams:

[ISO 10303 required]

The diagrams in this annex correspond to the EXPRESS schemas specified in this part of ISO 10303. The diagrams use the EXPRESS-G graphical notation for the EXPRESS language. EXPRESS-G is defined in annex D of ISO 10303-11.

[end required]

Use the following form for the caption of each figure containing an EXPRESS-G diagram:

[ISO 10303 required]

Figure <X>.<n> — EXPRESS-G diagram of the <schema_name> (<x> of <y>)

[end required]

where <X> is the annex number, <n> is the diagram number, and <x>,<y> are the ranges of the related figures for one schema.

7.5.3 Optional informative annexes

Additional informative annexes may be included if they provide additional information that helps the reader to understand the schemas documented in the part. They shall be lettered sequentially. Such annexes may include:

- examples of use;
- technical discussions;
- additional scope information that crosses multiple schemas or integrated resources parts.

7.6 Bibliography

The bibliography, if included, shall contain a list of reference documents that provide further explanation of the concepts contained in the part or constitute further reading. See 4.3.2 for requirements that apply to the bibliography.

7.7 Documentation of the index

The index of an integrated resources series part shall conform to the requirements given in 4.3.3. The index shall contain references to the declaration of each type, entity data type, function, and rule in the part. The index shall reference the page on which the EXPRESS language statements of the declaration begin, rather than the page on which the clause or subclause containing the declarations begin.

NOTE Since the underlined heading “EXPRESS specification” immediately precedes the EXPRESS declaration and always appears on the same page, this can be used as the target for the index entry.

The index shall contain only a single index entry for each EXPRESS element. Each index item shall contain only a single page number for each EXPRESS element.

The index may contain additional reference information; however, it shall not include the uses of an EXPRESS element.

8 Documentation of the application interpreted construct series of parts of ISO 10303

This clause gives rules and guidelines specific to documenting the application interpreted construct (AIC) series of parts of ISO 10303. Each part of ISO 10303 that is a member of the application interpreted construct series shall be documented separately. These documentation requirements supplement the requirements given in clauses 4 and 5 of this standing document. Information on the procedures for developing application interpreted constructs for ISO 10303 is provided in the Guidelines for development of application interpreted constructs .

An outline for the contents of an AIC is shown in Table 9.

Table 9 — Contents of an application interpreted construct

Foreword ^a
Introduction ^a
1 Scope
2 Normative references
3 Definitions
4 EXPRESS short listing
4.1 Fundamental concepts and assumptions
4.2 <aic schema name> type definitions
4.3 <aic schema name> entity definitions
4.4 <aic schema name> function definitions
Annex A (normative) Short names of entities
Annex B (normative) Information object registration
B.1 Document identification ^a
B.2 Schema identification ^a
Annex C (informative) EXPRESS-G diagrams
Annex D (informative) Computer interpretable listings
Annex E (informative) Technical discussions ^b
Bibliography ^b
Index
^a Do not list these elements in the table of contents.
^b These annexes or elements of the standard are optional and informative. Annexes shall be labelled in alphabetical order. If any of the optional annexes are omitted, adjust the labelling accordingly.

The elements of an application interpreted construct shall be documented in accordance with clause 4. In addition to the information outlined in 4.2.4, the introduction shall provide an overview of the technical content and the functionality of the AIC. The introduction may recommend informative references from the Bibliography for additional information on the application domain.

8.1 Documentation of scope

The scope shall be documented following the format outlined in 4.2.3. In addition to the information outlined in 4.2.3, the Scope clause shall include a summary of the functionality of the AIC. Required wording to introduce the Scope clause follows:

[ISO 10303 required]

This part of ISO 10303 specifies the interpretation of the integrated resources to satisfy requirements for < AIC functionality >.

The following are within the scope of this part of ISO 10303: <populate list as appropriate>

- <types of products supported>;
- <types of product data>;
- <uses of the product data supported>;
- <accommodated discipline views of the product (for example, electrical vs. mechanical discipline views)>.

The following are outside the scope of this part of ISO 10303: <populate list as appropriate>

- <types of products not supported>;
- <types of product data not supported>;
- <uses of the product data not supported>;
- <unsupported discipline views of the product>.

[end required]

The preceding list may not apply to all AICs. If not applicable, do not include it.

8.2 Documentation of normative references

The general requirements for the normative references clause are given in 4.2.4. The normative references clause of an application interpreted construct shall include ISO/IEC 8824-1, ISO 10303-1, ISO 10303-11, and ISO 10303-202, together with all other parts of ISO 10303 that are used by the AIC.

NOTE The reference ISO 10303-202 is necessary as this is the source for the definition of the term “application interpreted construct”. This requirement will not apply if and when this definition is moved to a new edition of ISO 10303-1.

8.3 Documentation of definitions

In addition to the information specified in 4.2.4.5, the definitions shall include any application-specific terms used in the introduction and scope clause. Where appropriate, terms defined in other documents should be listed with references to those documents and the definitions should not be repeated.

The following terms shall be referenced from ISO10303-1 if they are used in an AIC document:

- application;
- application context;
- application protocol (AP);

- implementation method;
- integrated resource;
- interpretation;
- product data.

Each AIC shall also include a definition of the term “application interpreted construct” in a subclause named “Terms defined in ISO 10303-202”. This may simply list the term without its definition (as in the case of the definitions referenced in Part 1, see above), or may be repeated as follows:

[ISO 10303 required]

3.x.x

application interpreted construct (AIC)

a logical grouping of interpreted constructs that supports a specific function for the usage of product data across multiple application contexts

[ISO 10303-202]

[end required]

The required wording to introduce repeated definitions is given in 4.2.5.3.

NOTE This repetition of a definition is an exception to the conventions applied to ISO 10303, in which repetition of definitions is deprecated.

8.4 Documentation of EXPRESS short listing

The EXPRESS short listing shall contain the interface specification between the integrated resources and the AIC schema. This clause shall consist of a schema containing the EXPRESS `USE FROM` statements followed by any EXPRESS elements that are unique to the AIC. Requirements for documentation of EXPRESS schemas are given in clause 5 of this standing document.

The following text shall be included as an introduction to the EXPRESS short listing:

[ISO 10303 required]

This clause specifies the EXPRESS schema that uses elements from the integrated resources and contains the types, entity data types specializations, and functions that are specific to this part of ISO 10303.

NOTE 1 There may be subtypes and items of select lists that appear in the integrated resources that are not imported into the AIC. Constructs are eliminated from the subtype tree or select list through the use of the implicit interface rules of ISO 10303-11. References to eliminated constructs are outside the scope of the AIC. In some cases, all items of the select list are eliminated. Because AICs are intended to be implemented in the context of an application protocol, the items of the select list will be defined by the scope of the application protocol.

[end required]

After completion of the `USE FROM` statements, a note shall list the part of ISO 10303 where each schema identified in the `USE FROM` statements is documented. The form of this note is described in 6.4.3.

The following text shall be included as an introduction to the Fundamental concept and assumptions clause:

[ISO 10303 required]

The following entity data types are intended to be independently instantiable in each application protocol schema that use this AIC:

[end required]

This wording shall be followed by an unordered list of entity data types names.

8.5 Documentation of annexes

The required annexes of an AIC are as follows:

- A Short names of entities (normative);
- B Information object registration (normative);
- C EXPRESS-G diagrams (informative);
- D Computer interpretable listings (informative).

Annexes with the following titles may be included if appropriate:

- E Technical discussions (informative);

8.5.1 Normative annexes

8.5.1.1 Short names of entities (annex A)

This annex shall be documented in accordance with 7.5.1.1.

8.5.1.2 Informative object registration (annex B)

Each ISO 10303 application interpreted construct shall contain an information object registration annex that specifies its document identification and the schema identification for each EXPRESS schema specified in the part. See annex B of these Supplementary Directives for the requirements that apply to information object registration annexes.

8.5.2 Required informative annexes

8.5.2.1 EXPRESS-G diagrams (annex C)

The EXPRESS-G diagrams shall be included as a set of figures in annex C. Rules for formatting these diagrams are specified in 6.5.

Use the following text to introduce the EXPRESS-G diagrams:

[ISO 10303 required]

The diagrams in this annex are generated from the short listing given in clause 4 and correspond to the EXPRESS schemas specified in this part of ISO 10303. The diagrams use the EXPRESS-G graphical notation for the EXPRESS language. EXPRESS-G is defined in annex D of ISO 10303-11.

NOTE The select types <select type1>, <select type 2>, ... and <select type n> are interfaced into the AIC expanded listing according to the implicit interface rules of ISO 10303-11. These select types are not referenced by other entities in this part of ISO 10303.

[end required]

Use the following form for the caption of each figure containing an EXPRESS-G diagram:

[ISO 10303 required]

Figure <X>.<n> — EXPRESS-G diagram of the <schema_name> (<x> of <y>)

[end required]

where <X> is the annex number, <n> is the diagram number, and <x>,<y> are the ranges of the related figures for one schema.

8.5.2.2 Computer interpretable listings (annex D)

Annex D shall provide electronic access to the list of short names provided in annex A and the EXPRESS specified in this part. This access is provided through the specification of URLs that identify the location of these files on the Internet. The EXPRESS file shall not contain any intervening prose; the EXPRESS listing for all schemas shall be found in one file. The listing shall not contain any comment delimiters of the kind “(*)” and “(*)” that separate the EXPRESS declarations from the main body of the prose. However, tail comments (those beginning with “--”) may be included.

Use the following text and format for documenting this annex. In the URL for the EXPRESS, replace “nnn” in “partnnn” with the number of this part of ISO 10303 and “is” with the stage of the part. Confirm the URL with the SC4 Secretariat prior to publication.

[ISO 10303 required]

This annex references a listing of the EXPRESS entity data type names and corresponding short names as specified in this part of ISO 10303. It also references a listing of each EXPRESS schema specified in this part of ISO 10303, without comments or other explanatory text. These listings are available in computer-interpretable form and can be found at the following URLs:

Short names:

<http://www.mel.nist.gov/div826/subject/apde/snr/>

EXPRESS:

<http://www.mel.nist.gov/step/parts/partnnn/is/>

If there is difficulty accessing these sites contact ISO Central Secretariat or contact the ISO TC 184/SC4 Secretariat directly at sc4sec@cme.nist.gov.

NOTE The information provided in computer-interpretable form at the above URLs is informative. The information that is contained in the body of this part of ISO 10303 is normative.

[end required]

8.5.3 Optional informative annexes

Relevant technical discussions may be provided as an annex. The format for this annex shall follow the format for the other annexes.

8.6 Bibliography

The bibliography, if included, shall contain a list of reference documents that provide further explanation of the concepts contained in the part or constitute further reading. See 4.3.2 for requirements that apply to the bibliography.

8.7 Documentation of index

The index of an application interpreted constructs series part shall conform to the requirements given in 4.3.3. The index shall contain references to the declaration of each type, entity data type, function, and rule in the part. The index shall reference the page on which the EXPRESS language statements of the declaration begin, rather than the page on which the clause or subclause containing the declarations begin.

NOTE Since the underlined heading “EXPRESS specification” immediately precedes the EXPRESS declaration and always appears on the same page, this can be used as the target for the index entry.

The index shall also contain references to the EXPRESS-G diagrams on which each type and entity data type appears. The AIC element index entries shall appear in the following manner:

[ISO 10303 required]

<AIC element name>

AIC diagrams ...

AIC EXPRESS short listing <plural of construct type> ...

[end required]

When the SIC element is an entity data type, replace <plural_of_construct_type> with “entity data types”.

NOTE The abbreviated term “entities” may also be used; however, the full term is preferred.

When the AIC element is a type, use “types”. When the AIC element is a rule, use “rules”. When the AIC element is a function, use “functions”.

The index shall not include attributes of AIC elements.

The index shall not include the uses of an AIC element.

9 Documentation of the application protocol series of parts for ISO 10303

This clause gives rules and guidelines specific to documenting the application protocol (AP) series of parts of ISO 10303. Each part of ISO 10303 that is a member of the application protocol series shall be documented separately. These documentation requirements supplement the requirements listed in clauses 4 and 5 of this standing document. Information on the procedures for developing application protocols for ISO 10303 is provided in the Guidelines for the development and approval of STEP application protocols.

NOTE This clause does not include requirements that apply to the documentation of ISO 10303 application protocols that are developed using application modules. These requirements will be added after approval and publication of the relevant guidelines [17].

An outline for the table of contents of an application protocol is shown in Table 10.

Table 10 — Contents of an application protocol

Foreword ^a

Introduction ^a

1 Scope

2 Normative references

3 Terms, definitions and abbreviations

4 Information requirements

4.1 Units of functionality

4.1.1 UoF1

4.1.2 UoF2

...

4.1.n UoFn

4.2 Application objects

4.3 Application assertions

5 Application interpreted model

5.1 Mapping specification ^b

5.2 AIM EXPRESS short listing

6 Conformance requirements

Annex A (normative) AIM EXPRESS expanded listing

Annex B (normative) AIM short names

Annex C (normative) Implementation method specific requirements

Annex D (normative) Protocol Implementation Conformance Statement (PICS) proforma

Annex E (normative) Information object registration

Annex F (informative) Application activity model

F.1 Application activity model definitions and abbreviations ^a

F.2 Application activity model diagrams ^a

Annex G (informative) Application reference model

Annex H (informative) AIM EXPRESS-G

Annex J (informative) Computer interpretable listing

Annex K (informative) Application protocol usage guide ^b

Annex L (informative) Technical discussions ^b

Bibliography

Index

Table 10 — Contents of an application protocol (concluded)

^a	Do not list these elements in the table of contents.
^b	If the application protocol is being developed using the Guidelines for the development of mapping tables, the title of this subclause is “Mapping table” (see 9.7.1).
^c	These annexes or elements of the standard are optional and informative. Annexes shall be labelled in alphabetical order. If any of the optional annexes are omitted, adjust the labelling accordingly.

The elements of an application protocol shall be documented in accordance with clauses 4 and 5. The following subclauses describe additional requirements that apply to the documentation of an application protocol.

9.1 Documentation of the table of contents

The table of contents of an AP shall follow the guidelines outlined in 4.1.3. The table of contents for an AP shall contain entries to the second level (the first subclause level) except for the units of functionality areas. The table of contents shall contain entries to the third level for the units of functionality (subclauses 4.1.1 ... 4.1.n of the AP).

9.2 Documentation of the introduction

In addition to the requirements described in 4.1.5.1.3, the introduction shall provide an overview of the technical content and the application domain of the AP. The introduction may recommend informative references from the bibliography for additional information on the application domain.

9.3 Documentation of scope

The scope shall be documented following the format outlined in 4.2.3. In addition to the information outlined in 4.2.3, the scope clause shall include a summary of the application context and domain of the AP. Required wording to introduce the scope clause follows:

[ISO 10303 required]

This part of ISO 10303 specifies the use of the integrated resources necessary for the scope and information requirements for <application purpose and context>.

NOTE The application activity model in annex F provides a graphical representation of the processes and information flows that are the basis for the definition of the scope of this part of ISO 10303.

The following are within the scope of this part of ISO 10303:

- <types of products supported>;
- <types of product data>;
- <uses of the product data supported>;
- <accommodated discipline views of the product (for example, electrical vs. mechanical discipline views)>

The following are outside the scope of this part of ISO 10303:

- <types of products not supported>;
- <types of product data not supported>;
- <uses of product data not supported>;
- <unsupported discipline views of the product.

[end required]

The preceding lists may not apply to all APs. Populate the lists as appropriate. If an item is not applicable, do not include it.

9.4 Documentation of normative references

In addition to the information outlined in 4.2.4, the normative references shall include all other parts of ISO 10303 that are used by the part being documented. APs using AICs shall include AICs that are referenced directly by the AP and indirectly referenced by directly referenced AICs (those AICs that are referenced by other AICs). ISO 10303-1 and ISO 10303-11 shall be included in this list.

9.5 Documentation of terms and definitions

In addition to the information outlined in 4.2.5, the terms and definitions clause of the AP shall include any application-specific terms used in the introduction, scope, and information requirements clauses but not defined in the information requirements clauses. The list of definitions shall not include objects defined within the application interpreted model. Where appropriate, terms defined in other normatively referenced documents should be listed with references to those documents and the definitions should not be repeated (see 4.2.5.2).

The list of terms referenced as being defined in ISO 10303-1 shall include, at a minimum, the terms from ISO 10303-1 that are found in the required text for the APs. The following terms shall be referenced from ISO10303-1 if they are used in an AP document:

- application;
- application activity model (AAM);
- application interpreted model (AIM);
- application object;
- application protocol (AP);
- application reference model (ARM);
- conformance testing;
- implementation method;
- integrated resource;
- PICS proforma;
- product;
- product data;
- unit of functionality (UoF).

9.6 Documentation of information requirements

The information requirements clause of the AP shall describe the functionality and information requirements of the application. This description is given in the language of the application but includes the terminology of data modelling. The information requirements shall include notes that reference the application activity model (annex F of the AP) and the application reference model (annex G of the AP) of the part being documented for explaining the relevance and roles of the required information.

The first paragraphs of this clause provide a high-level description of the information requirements that are supported by the AP. These information requirements may be organized by the different product types, life cycle phases, or application uses supported by the AP.

The title of the information requirements clause shall be “Information requirements”. Use the following required text to introduce the information requirements clause of the AP, including the notes, and format for documenting information requirements:

[ISO 10303 required]

4 Information requirements

This clause specifies the information required for <AP purpose>.

The information requirements are specified as a set of units of functionality, application objects, and application assertions. These assertions pertain to individual application objects and to relationships between application objects. The information requirements are defined using the terminology of the subject area of this application protocol.

NOTE 1 A graphical representation of the information requirements is given in annex G.

NOTE 2 The information requirements correspond to those of the activities identified as being within the scope of this application protocol in annex F.

NOTE 3 The <mapping table or mapping specification> specified in 5.1 shows how the integrated resources <and application interpreted constructs> are used to meet the information requirements of this application protocol.

[end required]

9.6.1 Units of functionality

The Units of Functionality (UoF) subclause shall list and define the units of functionality of the AP. A UoF is a collection of application objects and relationships that conveys one or more concepts within the application context. The definition of a UoF shall include the scope of the UoF, a description of the functionality that the UoF supports, and the lists of application objects included in the UoF. The practice of nesting UoFs is strongly discouraged. Each application object shall appear in at least one UoF.

The following rules apply to documenting UoFs:

- All UoFs shall be presented in lower case with underscores where appropriate. This format is to be used for headings and references from the text. Boldface shall only be used in the headings.
- All references to the UoF shall be made as the <name of UoF> UoF.
- Application objects included in each UoF shall be listed alphabetically.

Use the following required text and format for documenting UoFs:

[ISO 10303 required]

4.1 Units of functionality

This subclause specifies the units of functionality for the <title of the AP> application protocol. This part of ISO 10303 specifies the following units of functionality:

- <name of UoF 1>;
- <name of UoF 2>;
- ...
- <name of UoF n>.

The units of functionality and a description of the functions that each UoF supports are given below. The application objects included in the UoFs are defined in 4.2.

4.1.1 <name of UoF 1>

<definition of UoF 1>

The following application objects are used by the <name of UoF 1> UoF:

- <application object 1>;
- <application object 2>;
- ...
- <application object n>.

4.1.n <name of UoF n>

<definition of UoF n>

The following application objects are used by the <name of UoF n> UoF:

- <application object 1>;
- <application object 2>;
- ...
- <application object n>.

[end required]

9.6.2 Application objects

Each required application object shall be defined in a separate subclause. An application object is an atomic element that embodies a unique application concept and contains attributes that specify the data elements that the object comprises. Application object definitions correspond to the application reference model presented in annex G of the AP. Different requirements for documentation apply

based on the notation used for the application reference model – this notation may be EXPRESS-G (Annex D of ISO 10303-11) or IDEF1X (IEEE Std 1320.2⁶⁾).

9.6.2.1 Format for application objects

The following rules apply to documenting application objects:

- All application objects shall be presented with a leading upper case letter followed by lower case letters and underscores as necessary. This format shall be used for headings and references from text. Boldface shall be used when the object/attribute name is used in headings, but not in general text.
- The text that follows the name of the application object shall consist of a description of the object defined within the context of the AP. If the object is in a supertype/subtype relationship, this fact shall be included in the description.
- The definition of an application object shall be followed by the definitions of the attributes of that object.
- The application objects shall be defined in alphabetical order.
- Each application object shall be defined in a separate subclause.

Use the following required text and format for documenting the application objects clause:

[ISO 10303 required]

4.2 Application objects

This subclause specifies the application objects for the <title of the AP (in lowercase)> application protocol. Each application object is an atomic element that embodies a unique application concept and contains attributes specifying the data elements of the object. The application objects and their definitions are given below.

4.2.1 <Object_1>

A(n) <Object_1> is <description of the object within the context of the application. More than one sentence may be given here>.

[end required]

Or, in the case where the application object is a subtype in a supertype/subtype relationship, the first sentence states the supertype of which the object is a subset and provides a cross reference to the clause number of the definition of the supertype object.

⁶⁾ For the purposes of SC4 standards, IEEE Std 1320.2 is equivalent to the earlier FIPS PUB version of IDEF1X [3].

[ISO 10303 required]

A(n) <Object_1> is a type of <Supertype_object_name> (see 4.2.n) <description of the object within the context of the application. More than one sentence may be given here>.

[end required]

For application objects that are a supertype in a supertype/subtype relationship, the recommended wording is an additional sentence that states the existence dependencies. Cross references are provided with the clause number of the definition of each of the subtype objects.

Use the following if the supertype is existence-dependent on a subtype (IDEFIX complete categorization or EXPRESS ABSTRACT ONEOF supertype⁷⁾):

[ISO 10303 required]

Each <Object_1> is either a(n) <Subtype_object_name_1> (see 4.2.a), a(n) <Subtype_object_name_2> (see 4.2.c), ..., or a(n) <Subtype_object_name_n> (see 4.2.x).

[end required]

Use the following if the supertype is not existence dependent on a subtype (IDEFIX incomplete categorization or EXPRESS ABSTRACT ONEOF supertype):

[ISO 10303 required]

Each <Object_1> may be one of the following: a(n) <Subtype_object_name_1> (see 4.2.a), a(n) <Subtype_object_name_2> (see 4.2.c), ..., or a(n) <Subtype_object_name_n> (see 4.2.x).

[end required]

Use the following if the supertype has a single subtype:

[ISO 10303 required]

Each <Object_1> may be a(n) <Subtype_object_name> (see 4.2.a).

[end required]

If the application object includes attributes, list the attributes using the following format:

⁷⁾ See 9.9.2.2 for information about the notations that may be used.

[ISO 10303 required]

The data associated with a(n) <Object_1> are the following:

- <attribute_1>;
- <attribute_2>;
- ...
- <attribute_n>.

[end required]

9.6.2.2 Format for attributes of the objects

The following rules apply to documenting application object attributes:

- All attribute names shall be presented as lower case letters and underscores as necessary. This format shall be used for headings and references from text. Boldface shall be used when the object/attribute name is used in headings, but not in general text.
- The text that follows the name of the attribute shall consist of a description of the attribute defined within the context of the application object. If the attribute is an aggregate, optional, or a logical, these facts shall be included in the description. In the case of a logical attribute, the terms “logical flag” or “logical indicator” shall not be used; both conditions that the attribute creates shall be indicated.
- The attributes shall be defined in alphabetical order.
- Each attribute shall be defined in a separate subclause (4.2.x.y).

NOTE Even if there is only one attribute of an application object its definition shall be placed in a separate subclause; this is an exception to the requirements of the ISO/IEC Directives, Part 3, which requires that “a subclause shall not be created unless there is at least one further subclause at the same level”. The ISO Central Secretariat has granted an exception to SC4 in the case of attributes of application objects in the documentation of ISO 10303 application protocols.

Use the following format to document each attribute:

[ISO 10303 required]

4.2.1.1 **attribute_1**>

The <attribute_1> specifies the <role and nature of the attribute with respect to the object. More than one sentence may be given here.>

[end required]

For logical attributes, indicate both of the conditions that the attribute creates.

[ISO 10303 required]

The <attribute_1> specifies whether or not <condition the attribute creates with respect to the object. More than one sentence may be given here>.

[end required]

For optional attributes, include an additional sentence that states the following:

[ISO 10303 required]

The <attribute_1> need not be specified for a particular <Object_1>.

[end required]

For attributes that may be aggregated and are not assertions, include an additional sentence that states:

[ISO 10303 required]

There may be more than one <attribute_1> for a(n) <Object_1>.

[end required]

EXAMPLE Using EXPRESS-G modelling the aggregate may be a base type; using IDEF1X modelling the aggregate may be an attribute.

9.6.3 Application assertions

This subclause shall define the relationships and cardinalities among the application objects defined in the previous clause. Application assertions should not be used to document subsets. If one application object is a (proper) subset of another application object, that fact should be included in the definition of the application object. Equivalently, the verbs “is” and “are” should not be used to express relationships.

The following rules apply to documenting application assertions:

- list application objects in assertions in primary or forward order; do not include converse assertions;

NOTE 1 The primary order for an EXPRESS ARM is an entity with an attribute that contains a reference to another entity; for an IDEF1X ARM, it is the natural order from parent to child.

- order the assertions alphabetically by the first application object referenced;
- within the groups of assertions dealing with a given application object, order the assertions alphabetically by the second application object referenced;
- list the application assertion and its converse in a subclause;

NOTE 2 The assertions state the cardinalities between objects.

- use a verb specific to the application to state the role between objects;
- add the plural “objects” to the end of the assertion if the cardinality of the assertion is greater than one or the assertion is “zero or one”;

- list multiple assertions between objects under one heading with a blank line between the sets of assertions.

EXAMPLE The following example illustrates the form of text used to document assertions:

Each A supervises one or more B objects. Each B is supervised by exactly one A.

Use the following text and format for documenting the application assertions:

[ISO 10303 required]

4.3 Application assertions

This subclause specifies the application assertions for the <title of the AP> application protocol. Application assertions specify the relationships between application objects, the cardinality of the relationships, and the rules required for the integrity and validity of the application objects and UoFs. The application assertions and their definitions are given below.

4.3.1 <Abc_name> to <Bcd_name>

Each <Abc_name> <role_1> <cardinality_1> <Bcd_name> (objects). Each <Bcd_name> <inverse_role_1> <inverse_cardinality_1> <Abc_name> (objects).

Each <Abc_name> <role_2> <cardinality_2> <Bcd_name> (objects). Each <Bcd_name> <inverse_role_2> <inverse_cardinality_2> <Abc_name> (objects).

[end required]

9.6.4 Documenting EXPRESS ARMS

EXPRESS ARMs require slightly different documentation guidelines than IDEF1X ARMs. With an EXPRESS ARM it is difficult to initially distinguish between attributes and assertions.

The application object is defined with all attributes including those that represent assertions in clause 4.2 of the AP. Attributes that provide the assertions are also defined in clause 4.3 of the AP as the context or role within the application object that the attribute has. The attribute definitions in clause 4.2 of the AP provide a reference to the application assertion in clause 4.3 of the AP. Inverse attribute relationships may be used for an entity attribute definition and shall be used to provide assertion information. Annex C includes an example illustrating the required contents of clauses 4.2 and 4.3 of an AP whose ARM is defined in EXPRESS.

9.7 Documentation of application interpreted model

The application interpreted model (AIM) specifies the use of the integrated resources and application interpreted constructs necessary to satisfy the information requirements and constraints of the application reference model.

NOTE This clause will be amended as necessary in future editions of this document to take into account the use of other common resources (see 3.4.3) in the creation of an application interpreted model.

9.7.1 Mapping table

The requirements specified in this subclause apply to ISO 10303 application protocols that are being developed using the Guidelines for the development of mapping tables. See 9.7.2 for requirements

that apply to ISO 10303 application protocols that are being developed using the Guidelines for the development of mapping specifications.

NOTE At the time of publication of this document, the Guidelines for the development of mapping specifications were being prepared for publication. See [19] for the draft submitted for standing document ballot. The requirements of the revised guidelines apply to all ISO 10303 application protocols approved as New Work Items after the publication of the revised guidelines, and may be used by any other ISO 10303 application protocol project.

Guidance on developing and documenting mappings tables for ISO 10303 application protocols is provided in the Guidelines for the development of the mapping tables. The mapping table documents the correspondence between the information requirements defined in clause 4 of an AP and how the requirements are satisfied by the objects in the AIM. The mapping table subclause consists of a series of tables each of which documents the mapping for one unit of functionality as defined in 9.6.1. The tables shall be ordered alphabetically by UoF name. Application objects not included in any UoF shall be listed in the final table that shall be titled “Additional application objects”.

The following rules apply to documenting the mapping table:

- The title of subclause 5.1 in each AP shall be “Mapping table”. See 4.2.1 for general requirements relating to clauses and subclauses, and 5.3.1 for requirements relating to the format of clauses, subclauses, and their headings.

Use the following text to introduce the mapping tables subclause:

[ISO 10303 required]

5.1 Mapping table

This clause contains the mapping table that shows how each UoF and application object of this part of ISO 10303 (see clause 4) maps to one or more AIM constructs (see annex A). The mapping table is organized in five columns.

Column 1) Application element: Name of an application element as it appears in the application object definition in 4.2. Application object names are written in uppercase. Attribute names and assertions are listed after the application object to which they belong and are written in lower case.

Column 2) AIM element: Name of an AIM element as it appears in the AIM (see annex A), the term “IDENTICAL MAPPING”, or the term “PATH”. AIM entities are written in lower case. Attribute names of AIM entities are referred to as <entity name>.<attribute name>. The mapping of an application element may result in several related AIM elements. Each of these AIM elements requires a line of its own in the table. The term “IDENTICAL MAPPING” indicates that both application objects of an application assertion map to the same AIM element. The term “PATH” indicates that the application assertion maps to the entire reference path.

Column 3) Source: For those AIM elements that are interpreted from the integrated resources or the application interpreted constructs, this is the number of the corresponding part of ISO 10303. For those AIM elements that are created for the purpose of this part of ISO 10303, this is the number of this part. Entities or types that are defined within the integrated resources have an AIC as the source reference if the use of the entity or type for the mapping is within the scope of the AIC.

Column 4) Rules: One or more numbers may be given that refer to rules that apply to the current AIM element or reference path. For rules that are derived from relationships between application objects, the same rule is referred to by the mapping entries of all the involved AIM elements. The expanded names of the rules are listed after the table.

Column 5) Reference path: To describe fully the mapping of an application object, it may be necessary to specify a reference path through several related AIM elements. The reference path column documents the role of an AIM element relative to the AIM element in the row succeeding it. Two or more such related AIM elements define the interpretation of the integrated resources that satisfies the requirement specified by the application object. For each AIM element that has been created for use within this part of ISO 10303, a reference path up to its supertype from an integrated resource is specified.

For the expression of reference paths and the relationships between AIM elements the following notational conventions apply:

- a) `[]`: enclosed section constrains multiple AIM elements or sections of the reference path are required to satisfy an information requirement;
- b) `()`: enclosed section constrains multiple AIM elements or sections of the reference path are identified as alternatives within the mapping to satisfy an information requirement;
- c) `{}`: enclosed section constrains the reference path to satisfy an information requirement;
- d) `<>`: enclosed section constrains at one or more required reference path;
- e) `||`: enclosed section constrains the supertype entity;
- f) `->`: attribute references the entity or select type given in the following row;

- g) <-: entity or select type is referenced by the attribute in the following row;
- h) [i]: attribute is an aggregation of which a single member is given in the following row;
- i) [n]: attribute is an aggregation of which member n is given in the following row;
- j) =>: entity is a supertype of the entity given in the following row;
- k) <=: entity is a subtype of the entity given in the following row;
- l) =: the string, select, or enumeration type is constrained to a choice or value;
- m) \: the reference path expression continues on the next line.

[end required]

- The title of each table within the mapping table subclause shall be “Mapping table for <name of the UoF> UoF”. The title of each table shall be formatted as specified in 5.3.4.3.
- The border of each table shall be a single line. Column headings shall appear on each page of each subtable. The column headings shall be separated from the following entries by a double line. Mappings for all of the application objects within the UoF follow in alphabetical order. Each application object shall be specified on a single row of the table. Attributes and assertions for each application object follow on separate rows of the table, separated from the previous row by a single line. Objects within a UoF shall be separated from each other by double lines in the table.
- Each table in the mapping table subclause of an AP shall be presented in landscape mode (see 5.1.1, 5.3.4.1, and 5.3.4.3).
- Each table shall have five columns, titled “Application element”, “AIM element”, “Source”, “Rules”, and “Reference path”. All information in these columns shall be from normative elements; no objects shall be used from an informative annex. The contents of the first column are to be left justified and the contents of the remaining columns are to be centred.
- When the mapping is to IDENTICAL MAPPING or to PATH, no source is provided.

The documentation of the mapping table for an EXPRESS ARM follows the above rules with the following exception. The application object is defined followed by all attributes which are not assertions. Assertions follow these attributes and include the name of the attribute that provides the assertion.

NOTE Examples of the layout of a mapping table may be found in the Guidelines for the development of mapping tables.

9.7.2 Mapping specification

The requirements specified in this subclause apply to ISO 10303 application protocols that are being developed using the Guidelines for the development of mapping specifications. See 9.7.1 for requirements that apply to ISO 10303 application protocols that are being developed using the Guidelines for the development of mapping tables.

NOTE At the time of publication of this document, the Guidelines for the development of mapping specifications were being prepared for publication. See [19] for the draft submitted for standing document ballot. The requirements of the revised guidelines apply to all ISO 10303 application protocols approved as New Work Items after the publication of the revised guidelines, and may be used by any other ISO 10303 application protocol project.

Guidance on developing and documenting mappings specifications for ISO 10303 application protocols is provided in the Guidelines for the development of the mapping specifications. The mapping specification documents the correspondence between the information requirements defined in clause 4 of an AP and how the requirements are satisfied by the objects in the AIM. The mapping specification consists of a series of subclauses each of which documents the mapping for one unit of functionality as defined in 9.6.1. These subclauses shall be ordered alphabetically by UoF name. Application objects not included in any UoF shall be listed in the final subclause that shall be titled “Additional application objects”.

The following rules apply to documenting the mapping specification:

- The title of subclause 5.1 in each AP shall be “Mapping specification”. See 4.2.1 for general requirements relating to clauses and subclauses, and 5.3.1 for requirements relating to the format of clauses, subclauses, and their headings.

Use the following text to introduce the mapping specifications subclause:

[ISO 10303 required]

5.1 Mapping specification

This clause contains the mapping specification that shows how each UoF and application object of this part of ISO 10303 (see clause 4) maps to one or more AIM constructs (see annex A). Each mapping specifies up to five elements.

Application element: The mapping for each application element is specified in a separate subclause below. Application object names are capitalized. Attribute names and assertions are listed after the application object to which they belong and are written in lower case.

AIM element: Name of one or more AIM entity data types (see annex A), the term “IDENTICAL MAPPING”, or the term “PATH”. AIM entity data type names are written in lower case. Attributes of AIM entity data types are referred to as <entity name>.<attribute name>. The mapping of an application element may involve more than one AIM element. Each of these AIM elements is presented on a separate line in the mapping specification. The term “IDENTICAL MAPPING” indicates that both application objects involved in an application assertion map to the same instance of an AIM entity data type. The term “PATH” indicates that the application assertion maps to a collection of related AIM entity instances specified by the entire reference path.

Source: For those AIM elements that are interpreted from the integrated resources or the application interpreted constructs, this is the number of the corresponding part of ISO 10303. For those AIM elements that are created for the purpose of this part of ISO 10303, this is the number of this part.

Rules: One or more global rules may be specified that apply to the population of the AIM entity data types specified as the AIM element or in the reference path. For rules that are derived from relationships between application objects, the same rule is referred to by the mapping entries of all the involved AIM elements. A reference to a global rule may be accompanied by a reference to the subclause in which the rule is defined.

Reference path: To describe fully the mapping of an application object, it may be necessary to specify a reference path involving several related AIM elements. Each line in the reference path documents the role of an AIM element relative to the AIM element in the line following it. Two or more such related AIM elements define the interpretation of the integrated resources that satisfies the requirement specified by the application object. For each AIM element that has been created for use within this part of ISO 10303, a reference path to its supertype from an integrated resource is specified. For the expression of reference paths and the relationships between AIM elements the following notational conventions apply:

- [] enclosed section constrains multiple AIM elements or sections of the reference path are required to satisfy an information requirement;
- () enclosed section constrains multiple AIM elements or sections of the reference path are identified as alternatives within the mapping to satisfy an information requirement;
- { } enclosed section constrains the reference path to satisfy an information requirement;
- <> enclosed section constrains at one or more required reference path;
- || enclosed section constrains the supertype entity;
- > attribute references the entity or select type given in the following row;
- <- entity or select type is referenced by the attribute in the following row;

[i] attribute is an aggregation of which a single member is given in the following row;

[n] attribute is an aggregation of which member n is given in the following row;

=> entity is a supertype of the entity given in the following row;

<= entity is a subtype of the entity given in the following row;

= the string, select, or enumeration type is constrained to a choice or value;

\ the reference path expression continues on the next line;

// enclosed section is an instantiation of one of the mapping templates defined in 5.1.1 below;

-- the text following is a comment (normally a clause reference).

[end required]

EXAMPLE See C.2 for an illustration of the format of a mapping specification.

9.7.3 AIM EXPRESS short listing

9.7.3.1 General requirements

The AIM EXPRESS short listing is an EXPRESS schema specification containing the following elements:

- The interface specification that identifies the resource constructs from the ISO 10303 integrated resources and AICs that are used to satisfy the requirements of the AP.
- Definitions of additional types, entity data types, rules, and functions that specialize or otherwise constrain the imported resource constructs.
- Modifications to the definitions of constructs that are imported from the integrated resources.

9.7.3.2 Documentation of the AIM EXPRESS short listing

The general requirements for documentation of EXPRESS schemas described in 6.4 apply, together with the following specific requirements:

- The interface statements shall only contain EXPRESS USE FROM statements⁸⁾.
- Each modification to the definition of an imported type, entity data type, rule or function shall be defined in a separate subclause. Each subclause for type, entity, rule, and function shall be subdivided into a subclause for definitions and a subclause for imported construct modifications if there are any modifications to the imported integrated resource construct for each kind. Each definition or modification shall be provided in a separate subclause.

⁸⁾ In the ISO 10303 architecture, the REFERENCE FROM interface is used only to declare the relationships among integrated resource schemas.

9.7.3.3 EXPRESS style and usage

The general requirements for use of the EXPRESS language described in 6.2 and 6.3 apply, together with the following specific requirements:

- The name of the AIM schema shall be based on the title of the application protocol.

EXAMPLE 1 The title of ISO 10303-227 is “Industrial automation systems — Product data representation and exchange — Part 227: Application protocol: Plant spatial configuration. The name of the AIM schema of ISO 10303-227 is **plant_spatial_configuration**.

- String literals that convey application requirements in EXPRESS elements are to be written in lower case with spaces separating words.

EXAMPLE 2 If a rule is written to constrain the allowable values of an attribute with base type string, an appropriately written value would be ‘part number’ (and not ‘part_number’, ‘PART NUMBER’, or ‘part no.’).

- AIM-specific subtypes of entity data types defined in the **management_resources_schema** (ISO 10303-41) shall be named by prefixing the name of the resource construct by “applied_”.

EXAMPLE 3 The name of a subtype of **organization_assignment** that specifies the objects with which an organization can be associated should be **applied_organization_assignment**.

- AIM-specific subtypes of entity data types defined in the **management_resources_schema** (ISO 10303-41) shall follow the pattern defined in annex E of ISO 10303-41.

EXAMPLE 4 The following fragment of AIM EXPRESS declarations illustrates the correct usage of a construct defined in the **management_resources_schema**:

```
TYPE organization_item = SELECT
  (product,
   product_definition);
END_TYPE;

ENTITY applied_organization_assignment
  SUBTYPE OF (organization_assignment);
  items : SET [1:?] OF organization_item;
END_ENTITY;
```

9.7.3.4 Structure and contents of the AIM EXPRESS short listing subclause

The structure the AIM EXPRESS short listing clause shall conform to the requirements defined in 6.4 and 9.7.3.2.

EXAMPLE The example below illustrates the structure of the AIM EXPRESS short listing clause:

5 Application interpreted model

5.1 Mapping <table or specification>

5.2 AIM EXPRESS short listing

5.2.1 Fundamental concepts and assumptions

5.2.2 <AIM schema name> types

5.2.2.1	<AIM schema name> type definitions
5.2.2.1.1	<type 1>
5.2.2.1.2	<type 2>
5.2.2.1.n	<type n>
5.2.2.2	<AIM schema name> imported type modifications
5.2.2.2.1	<type 1>
5.2.2.2.2	<type 2>
5.2.2.2.n	<type n>
5.2.3	<AIM schema name> entities
5.2.3.1	<AIM schema name> entity definitions
5.2.3.1.1	<entity 1>
5.2.3.1.2	<entity 2>
5.2.3.1.n	<entity n>
5.2.3.2	<AIM schema name> imported entity modifications
5.2.3.2.1	<entity 1>
5.2.3.2.2	<entity 2>
5.2.3.2.n	<entity n>
5.2.4	<AIM schema name> rule definitions
5.2.4.1	<rule 1>
5.2.4.2	<rule 2>
5.2.4.n	<rule n>
5.2.5	<title of AP> function definitions
5.2.5.1	<function 1>
5.2.5.2	<function 2>
5.2.5.n	<function n>

Where only one item is included at a given level in the structure (such as only one rule being defined), no additional level of subclause is required.

Use the following required text and format to introduce the AIM EXPRESS short listing:

[ISO 10303 required]

5.2 AIM EXPRESS short listing

This clause specifies the EXPRESS schema that uses elements from the integrated resources <and the AICs> and contains the types, entity specializations, rules, and functions that are specific to this part of ISO 10303. This clause also specifies modifications to the text for constructs that are imported from the integrated resources <and the AICs>. The definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes that are not imported into the AIM. Requirements stated in the integrated resources that refer to select list items and subtypes apply exclusively to those items that are imported into the AIM.

[end required]

If AICs are not used, the phrase “and the AICs” shall not appear in either of the first two sentences of the required wording.

The documentation for imported type and entity data type modifications shall follow the form used for entity and type definitions given in 6.4.8 and 6.4.9.

The following text shall follow the title of the subclause:

[ISO 10303 required]

The base definition of the <construct name> <entity or type> is given in ISO 10303-<insert source part number>. The following modifications apply to this part of ISO 10303.

[end required]

The following types of imported text modifications have been identified for documentation in this clause of the AP document:

- addition of application specific examples;
- clarification of the interpretation of the meaning of a particular construct;
- clarification of the interpretation of the meaning of one or more attributes of an imported entity;
- specification of additional informal propositions;
- specification of associated global rules.

The definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes that are not imported into the AIM.

The integrated resources contain entity data types that have a supertype relationship to other entities in the integrated resource schema. When imported into the AIM, some of the subtypes of that entity may be eliminated in the using schema. Similarly the domain of a select type may be pruned. When such pruning occurs this pruning shall be documented in the fundamental concepts and assumptions subclause.

Application-specific examples may be defined by the AP developers to provide the implementer of the AP with a better idea of the meaning of a particular construct within the context of the AIM. The examples shall be documented in the same way as other examples (see 4.4.4).

An application protocol may require a generic definition from the integrated resources to be made more specific within the context of the AIM. Use the following text shall be used to introduce a general modification or addition to the definition of an imported construct:

[ISO 10303 required]

The definition of <construct name> is modified as follows:

[end required]

An application protocol may require the generic definition of an attribute or attributes of a particular entity data type to be made more specific within the context of the AIM. These shall be documented in a subclause for the imported entity modifications of the entity to which the attribute belongs. The following text shall be used to introduce a modification to attribute definitions:

[ISO 10303 required]

The attribute definitions are modified as follows:

[end required]

The above text shall follow the attribute definitions heading. The modified or extended attribute definitions shall then be documented in the same manner as defined in 6.4.9.1.

Any additional informal propositions that are defined for imported entity data types from the integrated resources shall be documented in a subclause for the imported entity modifications or the entity to which the proposition applies. The following text shall introduce the additional informal propositions:

[ISO 10303 required]

The following additional informal propositions apply:

[end required]

The above text shall follow the informal propositions heading. The informal propositions shall then be documented in the same manner as defined in the layout style rules in 6.4.9.1.

All global rules that are defined in the AIM and apply to imported entity types from the integrated resources shall be documented in the imported entity modifications subclause for each entity to which one or more rules apply. The heading “Associated global rules:” shall be used. The following text shall introduce the associated global rules:

[ISO 10303 required]

The following global rules defined in this part of ISO 10303 apply to the <entity name> entity:

[end required]

This wording will be followed by an unordered list of global rule names, each of which is followed by a reference to the relevant subclause.

EXAMPLE The following example illustrates the reference to one rule in such a list:

— rule_name_for_this_entity (See 5.2.4.n.)

9.8 Documenting conformance requirements

Clause 6 of each ISO 10304 application protocol shall specify the conformance requirements and the required level of completeness for conforming implementations of the AP. This clause may reference the abstract test suite for the AP.

Additional conformance requirements for specific types of implementation shall be referenced in this clause and fully explained in annex C of the AP being documented.

Use the following required text and format as an introduction:

[ISO 10303 required]

6 Conformance requirements

Conformance to this part of ISO 10303 includes satisfying the requirements stated in this part, the requirements of the implementation method(s) supported, and the relevant requirements of the normative references.

An implementation shall support at least one of the following implementation methods:

— <reference to one or more parts in implementation method series, for example, ISO 10303-21>.

Requirements with respect to implementation methods-specific requirements are specified in annex C.

The Protocol Implementation Conformance Statement (PICS) proforma lists the options or the combinations of options that may be included in the implementation. The PICS proforma is provided in annex D.

[end required]

If the AP specifies more than one conformance class, the following text should be used:

[ISO 10303 required]

This part of ISO 10303 provides for a number of options that may be supported by an implementation. These options have been grouped into the following conformance classes: <Provide a brief description of the classes.> Support for a particular conformance class requires support of all the options specified in that class.

Conformance to a particular class requires that all AIM elements defined as part of that class be supported. Table <number> defines the classes to which each AIM element belongs.

[end required]

This text should be followed by a series of subclauses specifying the options within each conformance class and a conformance class table. The conformance class shall indicate the AIM elements that are included in each conformance class.

EXAMPLE An example of a conformance class table is shown below.

Table n — Conformance class elements

AIM element	class				
	1	2	3	4	5
AIM_element_1	X			X	
AIM_element_2		X	X		
AIM_element_3					X

If the AP specifies only one conformance class, the following text should be used:

[ISO 10303 required]

This part of ISO 10303 provides for only one option that may be supported by an implementation. This option shall be supported by a single class of conformance that consists of all the units of functionality for this part of ISO 10303.

[end required]

A note shall identify the abstract test suite for the AP. For those abstract test suites that are not yet published, a footnote shall be added to the note to indicate that the abstract test suite is to be published. The note shall be of the form:

[ISO 10303 required]

NOTE ISO 10303-*<part number>* defines the abstract test suite to be used in the assessment of conformance *<include footnote if not yet IS>*. ISO 10303-32 describes the conformance assessment process.

[end required]

Unless it is otherwise included as a normative reference, ISO 10303-32 shall be listed in the AP's bibliography.

9.9 Documentation of annexes

The required annexes of an AP are as follows:

- Annex A (normative) AIM EXPRESS expanded listing;
- Annex B (normative) AIM short names;
- Annex C (normative) Implementation method specific requirements;
- Annex D (normative): Protocol Implementation Conformance Statement (PICS) proforma;
- Annex E (normative) Information object registration ;
- Annex F (informative) Application activity model ;
- Annex G (informative) Application reference model;

- Annex H (informative) AIM EXPRESS-G;
- Annex J (informative) Computer interpretable listing.

Annexes with the following titles may be included if appropriate:

- Annex K (informative) Application protocol usage guide;
- Annex L (informative) Technical discussions.

Annexes shall be labelled in alphabetical order; however the letter “P” shall be omitted from the order. If any of the optional annexes are not included, adjust the labelling accordingly.

9.9.1 Normative annexes

9.9.1.1 AIM EXPRESS expanded listing (annex A)

The AIM EXPRESS expanded listing is derived from the AIM EXPRESS short listing (provided in 5.2 of the application protocol document), and is documented in annex A. The AIM EXPRESS expanded listing is the documentation of the expanded EXPRESS `USE FROM` statements and the AP specific EXPRESS declarations.

The EXPRESS expanded listing shall be preceded by the following text:

[ISO 10303 required]

The following EXPRESS is the expanded form of the short form schema given in 5.2. In the event of any discrepancy between the short form and this expanded listing, the expanded listing shall be used.

[end required]

The AIM EXPRESS listing is documented in accordance with the following rules:

- The layout and style rules for EXPRESS language statements given in 6.1 and 6.2 apply.
- The listing shall be separated from the main body of the annex by comment delimiters “*)” and “(*”. Within the listing, no other comment delimiters shall be included that separate the EXPRESS declarations from the main body of the prose. However, tail comments (single-line comments beginning with “--” may be included.
- EXPRESS declarations shall be in the following order:
 - constant,
 - type,
 - entity data type,
 - rule,
 - function, and
 - procedure.

9.9.1.2 AIM short names (annex B)

The AIM short names annex shall contain a table of all the entities defined in annex A and their corresponding short names. This table and its contents shall follow the requirements described for the corresponding annex of an integrated resource part (see 7.5.1.1). The table shall be titled “AIM short names of entities”. Use the following text to introduce the table.

[ISO 10303 required]

Table B.1 provides the short names of entities specified in the AIM of this part of ISO 10303. Requirements on the use of the short names are found in the implementation methods included in ISO 10303.

[end required]

9.9.1.3 Implementation method-specific requirements (annex C)

This annex shall include any implementation method-specific requirements beyond those stated in clause 6. If there are no such requirements, include the following sentence:

[ISO 10303 required]

There are no implementation method-specific requirements for this part of ISO 10303.

[end required]

However, most APs require that the header section of an exchange structure (ISO 10303-21) identify the AIM schema (only). In this case, include the following text:

[ISO 10303 required]

The implementation method defines what types of exchange behaviour are required with respect to this part of ISO 10303. Conformance to this part of ISO 10303 shall be realized in an exchange structure. The file format shall be encoded according to the syntax and EXPRESS language mapping defined in ISO 10303-21 and in the AIM defined in annex A of this part of ISO 10303. The header of the exchange structure shall identify use of this part of ISO 10303 by the schema name ‘<schema_name>’.

[end required]

9.9.1.4 Protocol Implementation Conformance Statement (PICS) proforma (annex D)

The Protocol Implementation Conformance Statement (PICS) proforma shall be included as appendix D. The PICS proforma shall cover all options and conditional functions, elements of procedure, parameters, options, and other capabilities identified in the AP. The PICS proforma shall be in the form of a questionnaire to be completed by the supplier or implementer of an implementation of the relevant AP.

Use the following text and format for documenting PICS proforma:

[ISO 10303 required]

This clause lists the optional elements of this part of ISO 10303. An implementation may choose to support any combination of these optional elements. However, certain combinations of options are likely to be implemented together. These combinations are called conformance classes and are described in the subclauses of this annex.

This annex is in the form of a questionnaire. This questionnaire is intended to be filled out by the implementer and may be used in preparation for conformance testing by a testing laboratory. The completed PICS proforma is referred to as a PICS.

[end required]

9.9.1.5 Information object registration (annex E)

Each AP shall include an annex giving information object identifiers as defined in ISO/IEC 8824-1. See annex B for details of the required contents of this annex of the AP.

9.9.2 Required informative annexes

9.9.2.1 Application activity model (annex F)

The application activity model (AAM) shall be included as annex F of the AP. The AAM provides a representation of the activities that use product data in the application context. The AAM should be represented in the IDEF0 activity modelling format (IEEE Std 1320.1⁹⁾), although other formats may be used.

Use the following text to introduce annex F:

[ISO 10303 required]

The application activity model (AAM) is provided as an aid to understanding the scope and information requirements defined in this application protocol. The model is presented as a set of figures that contain the activity diagrams and a set of definitions of the activities and their data. Activities and data flows that are out of scope are marked with an asterisk.

[end required]

Examples of in-scope and out-of-scope elements may be included for clarification.

Normally the application activity model annex of an AP will be divided into two subclauses titled “Application activity model definitions” (see 9.9.2.1.1) and “Application activity model diagrams” (see 9.9.2.1.2). A third subclause may be included that describes the relationship between the application activity model and the application reference model (see 9.9.2.1.3).

An application protocol may, however, include more than one activity model; for example, an AP could include one activity model describing in detail the activities that are supported by the AP, and a second activity model that places these activities in a wider context. In this case the title of annex F shall be “Application activity models” and each activity model shall be documented in a separate subclause. These subclauses shall be further subdivided into definitions and diagrams.

⁹⁾ For the purposes of SC4 standards, IEEE Std 1320.1 is equivalent to the earlier FIPS PUB version of IDEF0 [1].

EXAMPLE The example below illustrates the structure of annex F of an application protocol that contains two activity models.

F.1 <descriptive title of first activity model>

F.1.1 Application activity model definitions

F.1.2 Application activity model diagrams

F.1.3 AAM/ARM correspondence

F.2 <descriptive title of second activity model>

F.2.1 Application activity model definitions

F.2.2 Application activity model diagrams

If an AP includes more than one activity model then only one of them need fully satisfy the requirements of this clause; additional activity models may, for example, omit definitions or be incomplete. Text should be included in this annex of the application protocol explaining that the additional activity model(s) are provided to support understanding of the main activity model.

9.9.2.1.1 Application activity model definitions

Use the following text to introduce the application activity model definitions subclause:

[ISO 10303 required]

The following terms are used in the application activity model. Terms marked with an asterisk are outside the scope of this application protocol.

The definitions given in this annex do not supersede the definitions given in the main body of the text.

[end required]

Include definitions of each activity, input, control, output and mechanism depicted in the AAM, using the following format:

- Each definition shall be numbered using legal style numbering (see 4.2.1).
- The number and the name of the item being defined shall be in boldface.
- If the item is out of scope, place an asterisk “*” after its name.
- Separate the name of the item and its definition by a colon and one space.
- The definition of the item may be a phrase or one or more sentences that explain the item.
- Examples may be included.

EXAMPLE The following example illustrates the format for definitions within an application activity model:

F.1.1 <name of item>: <definition of item>

F.1.2 <name of out-of-scope item>*: <definition of item>**9.9.2.1.2 Application activity model diagrams**

Use the following text to introduce the application activity model diagrams subclause:

[ISO 10303 required]

The application activity model diagrams are given in Figures F.1 through F.n. The graphical form of the application activity model is presented in the IDEF0 activity modelling format <insert reference to the bibliography>. Activities and data flows that are out of scope are marked with asterisks.

[end required]

If there are no activities or flows out of scope, the last sentence shall be omitted.

If a format other than IDEF0 is used for the activity model, substitute appropriate text describing or referencing the format used.

9.9.2.1.3 AAM/ARM correspondence

This optional part of the application activity model documentation describes the relationships between the inputs, controls, outputs, and mechanisms described by the activity model, the units of functionality defined in clause 4.1 of the application protocol, and the application objects defined in clause 4.2 of the application protocol. The relationships described may also indicate how conformance classes correspond to the activities depicted by the activity model.

There is no required content or format for this part of annex F of an application protocol.

9.9.2.2 Application reference model (annex G)

The application reference model (ARM) shall be included as annex G of the application protocol. A formal information modelling notation shall be used for the ARM – this notation may be EXPRESS-G (annex D of ISO 10303-11) or IDEF1X (IEEE Std 1320.2¹⁰⁾).

Use the following text to introduce the application activity model:

[ISO 10303 required]

This annex provides the application reference model for this part of ISO 10303. The application reference model is a graphical representation of the structure and constraints of the application objects specified in clause 4. The graphical form of the application reference model is presented in <insert the proper name of the graphical form, IDEF1X or EXPRESS-G>. The application reference model is independent from any implementation method.

[end required]

Append the following sentence to the introduction text if the diagrams use the EXPRESS-G graphical notation:

¹⁰⁾ For the purposes of SC4 standards, IEEE Std 1320.2 is equivalent to the earlier FIPS PUB version of IDEF1X [3].

[ISO 10303 required]

EXPRESS-G is defined in annex D of ISO 10303-11.

[end required]

Append the following sentence to the introduction text if the diagrams use the IDEF1X graphical notation:

[ISO 10303 required]

The diagrams use the IDEF1X graphical notation [n].

[end required]

Where “[n]” is the reference to the Bibliography for IDEF1X (either IEEE Std 1320.2 or FIPS PUB 184).

Use the following form for the caption of each ARM diagram

[ISO 10303 required]

Figure G.<n> — ARM diagram (<j> of <k>)

[end required]

where <n> is the figure number within annex G of the AP, <j> is the serial number of the diagram within the ARM, and <k> is the total number of diagrams that make up the ARM.

9.9.2.3 AIM EXPRESS-G (annex H)

The AIM EXPRESS-G diagrams shall be included as annex H of the application protocol. Rules for formatting these diagrams are found in 6.5.

Use the following text to introduce the AIM EXPRESS-G diagrams:

[ISO 10303 required]

The diagrams in this annex correspond to the AIM EXPRESS expanded listing given in annex A. The diagrams use the EXPRESS-G graphical notation for the EXPRESS language. EXPRESS-G is defined in annex D of ISO 10303-11.

[end required]

Use the following form for the caption of each figure containing an EXPRESS-G diagram.

[ISO 10303 required]

Figure H-<n> — AIM EXPRESS-G diagram <subject area of diagram>

[end required]

where <n> is the figure number within annex G of the AP.

9.9.2.4 Computer interpretable listings (annex J)

Annex J of the application protocol shall provide electronic access to the list of short names provided in annex A and the EXPRESS specified in the part. This access is provided through the specification of URLs that identify the location of these files on the Internet. The EXPRESS file shall be the same as the EXPRESS schema presented in annex A of the application protocol.

Use the following text and format for documenting this annex. In the URL for the EXPRESS, replace “nnn” in “partnnn” with the ISO 10303 part number of the application protocol and “is” with the stage of the part. Confirm the URL with the SC4 Secretariat prior to publication.

[ISO 10303 required]

This annex provides a listing of the complete EXPRESS schema specified in annex A of this part of ISO 10303 without comments or other explanatory text. It also provides a listing of the EXPRESS entity names and corresponding short names as specified in annex B of this part of ISO 10303. The content of this annex is available in computer-interpretable form and can be found at the following URLs:

- Short names: <http://www.mel.nist.gov/div826/subject/apde/snr/>
- EXPRESS: <http://www.mel.nist.gov/step/parts/partnnn/is/>

If there is difficulty accessing these sites contact ISO Central Secretariat or contact the ISO TC 184/SC4 Secretariat directly at: sc4sec@cme.nist.gov.

NOTE The information provided in computer-interpretable form at the above URLs is informative. The information that is contained in the body of this part of ISO 10303 is normative.

[end required]

9.9.3 Optional informative annexes

9.9.3.1 Application protocol usage guide

An AP usage guide may be provided as an annex. This annex documents AP usage guidelines and gives descriptions of how application integrated constructs should be used.

9.9.3.2 Technical discussions

Relevant technical discussions may be provided as an annex. If provided, they shall follow the format used to prepare the other annexes.

9.10 Bibliography

Each application protocol shall include a bibliography. The entries in the bibliography shall include:

- a reference to the activity modelling format used for annex F of the AP (generally IDEF0);
- a reference to the IDEF1X information modelling format if IDEF1X has been used for the ARM diagrams in annex G of the AP;
- a reference to ISO 10303-32 if this is cited in clause 6 of the AP (see 9.8) unless this standard is also referenced normatively;

- references to all documents that are cited informatively (in the foreword, introduction, notes, examples, or informative annexes);
- references to additional documents that have been used as reference material during the development of the application protocol.

Use the following text to reference the IDEF0 standard:

[ISO 10303 required]

[<n>] *IDEF0 Federal Information Processing Standards Publication 183, Integration Definition for Functional Modeling (IDEF0)*, FIPS PUB 183, National Institute of Standards and Technology, December 1993.

[end required]

If the IEEE version of IDEF0 has been used, substitute the following:

[ISO 10303 required]

[<n>] IEEE Std 1320.2-1998, *Standard for Conceptual Modeling Language - Syntax and Semantics for IDEF1X*.

[end required]

9.11 Documentation of index

The index of an application protocol shall satisfy the general requirements for indexes (see 4.3.3).

In addition to the information outlined in 4.3.3, the index shall list locations of the definitions of units of functionality, application objects, and AIM elements.

For each application object defined in clause 4.2 of the AP, the index shall list the location of the application object definition, the location of each application assertion that the object participates in, the location of the application object in the mapping table, and the location of the application object in the ARM diagrams. The application object index entries shall appear in the following manner:

ISO 10303 required

application_object_name	n
application assertion	o
application object	p
ARM diagrams	q
mapping table	r

[end required]

The index shall not include attributes of application objects, or assertions except as listed under the application objects that participate in the assertion as shown above.

Similarly, AIM elements may be described in multiple locations. For each AIM element, the index shall list the locations of the AIM short listing definition; should it exist; the location in the AIM expanded listing; the location of the AP specific AIM element where it appears in the AIM element col-

umn of the mapping table; and the location of the AIM element in the AIM diagrams. The AIM element index entries shall appear in the following manner:

ISO 10303 required

AIM_element_name	n
AIM diagrams	o
AIM EXPRESS listing <plural_of_construct_type>	p
AIM EXPRESS short listing <plural_of_construct_type>	q
mapping table	r

[end required]

When the AIM element is an entity data type, replace <plural_of_construct_type> with “entity data types”.

NOTE The abbreviated term “entities” may also be used; however, the full term is preferred.

When the AIM element is a type, use “types”. When the AIM element is a rule, use “rules”. When the IM element is a function, use “functions”.

The index shall not include attributes of AIM elements.

The index shall not include the uses of an application object or AIM element.

10 Documentation of abstract test suite series of parts of ISO 10303

This clause gives rules and guidelines specific to documenting the abstract test suite (ATS) series of parts of ISO 10303. Each part of ISO 10303 that is a member of the abstract test suite series shall be documented separately. These documentation requirements supplement the requirements listed in clauses 4 and 5 of this standing document. Information on the procedures for developing an abstract test suite is provided in the Guidelines for the development of abstract test suites.

An outline for the table of contents of an application protocol is shown in Table 11.

Table 11 — Contents of an abstract test suite part

Foreword ^a

Introduction ^a

1 Scope

2 Normative references

3 Terms, definitions, and abbreviations ^b

3.1 Terms defined in ISO 10303-1

3.2 Terms defined in ISO 10303-31

...

3.m Other terms and definitions

3.n Abbreviations ^b

4 Test purposes

4 Test purposes

4.1 Application element test purposes

4.2 AIM test purposes

4.3 Domain test purposes ^c

4.4 Implementation method test purposes ^c

4.5 Other test purposes ^c

5 General test purposes and verdict criteria

5.1 General test purposes

5.2 General verdict criteria for all abstract test cases

5.3 General verdict criteria for preprocessor abstract test cases

5.4 General verdict criteria for postprocessor abstract test cases

6 Abstract test cases

6.1 <Title of abstract test case 1>

6.1.1 Preprocessor

6.1.2 Postprocessor

... additional postprocessor test cases

6.2 <Title of abstract test case 2>

...

6.n <Title of abstract test case n>

Annex A (normative) Conformance classes

Annex B (normative) Postprocessor input specification file names

Annex C (normative) Information object registration

Annex D (informative) Usage scenarios ^c

Table 11 — Contents of an abstract test suite part

- ^a Do not list these elements in the table of contents.
- ^b See 4.2.5 for permitted titles for these subclauses.
- ^c 4.3-4.5 shall be present in the ATS only if it includes these classes of test purposes.
- ^c Additional informative annexes may be added by the ATS project team as needed.

10.1 Title

The title of an abstract test suite shall be as follows.

ISO 10303 required

Industrial automation systems and integration — Product data representation and exchange —Part
<part number>: Abstract test suite: <Same title as corresponding AP>

[end required]

This title shall be included on the cover page (see 4.1.1) and as the title element of the ATS (see 4.2.2).

10.2 Documentation of the table of contents

The table of contents for an ATS shall conform to the general requirements described in 4.1.3. The table of contents for an ATS shall contain entries to the first subclause level, except for test cases (defined in clause 6 of the ATS) which shall be listed to the to the second level of subclause.

10.3 Documentation of the introduction

See 4.1.5.1.4 for the requirements that apply to the introduction of an abstract test suite.

10.4 Documentation of scope

The scope shall be documented according to the requirements described in 4.2.3. Use the following wording to introduce the scope clause:

[ISO 10303 required]

This part of ISO 10303 specifies the abstract test suite to be used in the conformance testing of implementations of ISO 10303-*<part number of corresponding AP>*. The following are within the scope of this part of ISO 10303:

- the specification of the test purposes associated with ISO 10303-*<part number of corresponding AP>*;
- the verdict criteria to be applied during conformance testing of an implementation of ISO 10303-*<part number of corresponding AP>* using ISO 10303-21 or ISO 10303-22;

NOTE The verdict criteria are used to ascertain whether a test purpose has been satisfactorily met by an implementation under test (IUT) within the context of a given test case.

- the abstract test cases to be used as the basis for the executable test cases for conformance testing.

The following are outside the scope of this part of ISO 10303:

- the creation of executable test cases;
- test specifications for tests other than conformance testing such as interoperability or acceptance testing;
- other implementation methods.

[end required]

10.5 Documentation of normative references

In addition to the information outlined in 4.1.3, the normative references for an ATS shall include references to ISO 10303-21, -22, -31, -32, -34, and to the edition of the AP on which it is based. The AP reference shall include any amendments that are incorporated into the ATS.

NOTE Any Technical Corrigenda that have been published for the corresponding AP are automatically included via the normative reference. If the ATS is dependent on a correction published in a TC, this should be noted at the start of clause 4 of the ATS. If a correction to an AP published as a TC invalidates any part of the corresponding ATS, a Technical Corrigendum to the ATS should be developed that makes corresponding corrections to those published for the AP.

If the ATS uses EXPRESS-I, it shall also reference ISO/TR 10303-12. An ATS also shall normatively reference other normative sources of requirements in the AP that result in test purposes.

References that are already covered by the AP do not need to be normatively referenced in the ATS unless test purposes are included that result directly from the other standard. For example, references to the ISO 10303 integrated resource parts shall not be included in the ATS, because no test purposes will result directly from those parts.

10.6 Documentation of terms and definitions

In addition to the information outlined in 4.2.5, the terms and definitions clause shall include terms defined in other normative standards that are used in the document. Such terms shall be listed with references to those documents and the definitions shall not be repeated. If there are any new terms introduced in the abstract test suite, they shall be defined in clause 3 of the ATS.

The following terms defined in ISO 10303-1 shall be referenced in each ATS. If other terms from ISO 10303-1 are used, they shall also be included.

- abstract test suite;
- application object;
- application protocol (AP);
- implementation method.

The following terms defined in ISO 10303-31 shall be referenced in each ATS. If other terms from ISO 10303-31 are used, they shall also be included.

- abstract test case;
- conformance testing;
- executable test case;
- implementation under test (IUT);
- test purpose;
- verdict criterion.

Each ATS shall include a subclause for “Other terms and definitions” including at least the following definition:

ISO 10303 required

3.x.y

application element (AE)

application object, attribute of an application object, or assertion of a relationship between two application objects

NOTE Inclusion of this definition in each ATS is a temporary requirement, pending addition of this to a new edition of ISO 10303-1.

The abbreviations “AP”, “AE”, and “IUT” (together with any other abbreviations used in the ATS) shall be listed in a separate abbreviations subclause (see 4.2.5.4).

Appropriate terms defined in the source AP shall also be included in clause 3.

10.7 Documentation of test purposes

Use the following required text and format as an introduction to the test purposes clause.

[ISO 10303 required]

4 Test purposes

This clause specifies the test purposes for this part of ISO 10303. Clauses 4.1 and 4.2 describe the source and meaning of test purposes that are derived from the information requirement defined in ISO 10303-~~<part number of corresponding AP>~~, clause 4, and the AIM EXPRESS schema defined in ISO 10303-~~<part number of corresponding AP>~~, annex A. These test purposes are not repeated in this part of ISO 10303. However, through reference in a test case each specific element from the application elements or the AIM implicitly requires that the identified element, as specified in the test purpose statement, will be correctly instantiated by the implementation under test.

Implementation method test purposes in 4.3 are derived from ISO 10303-21. Domain test purposes in 4.4 are derived from domain requirements in the AP that are not clearly specified at the application element level. ~~<Describe here the source(s) of domain test purposes included in the ATS.>~~ Other test purposes are described in 4.5. Implementation method, domain and other test purposes are individually identified by the prefix “other” in the test purpose number. These test purposes are statements of requirements that shall be met by a conforming implementation.

[end required]

Modify the second paragraph above if the ATS does not include implementation method test purposes, domain test purposes, or other text purposes.

10.7.1 Application element test purposes

This subclause shall describe the source of the derived application element test purposes and the meaning of those test purposes, but shall not contain the test purposes themselves. The only content of this subclause is the following required text:

[ISO 10303 required]

4.1 Application element test purposes

Application element (AE) test purposes are implicitly derived from the AP information requirements and are not explicitly documented here. AE test purposes apply to the input specifications of both pre-processor and postprocessor test cases. AE test purposes are implicitly derived from the AP information requirements as follows:

- Application objects (see ISO 10303-*<part number of corresponding AP>*, 4.2): a test purpose derived from an application object is a simple statement of the object's name.
- Application object attributes (see ISO 10303-*<part number of corresponding AP>*, 4.2): test purposes derived from application object attributes are statements of the application object name with a specific attribute name.
- Application assertions (see ISO 10303-*<part number of corresponding AP>*, 4.3): test purposes derived from application assertions are statements describing the relationship between two application objects. Application assertion test purposes address the directions of relationships as well as the number (cardinality) of relationships.

They shall be interpreted as given in the following statement: the IUT shall preserve the semantic associated with the unique application element from which the test purpose was implicitly derived. This implies that the semantics of the application element are preserved by the IUT between the input and output of a test, according to the reference path specified in the mapping table defined in ISO 10303-*<part number of corresponding AP>*, 5.1.

[end required]

10.7.2 AIM test purposes

This subclause of the ATS shall describe the source of the derived application interpreted model test purposes and the meaning of those test purposes, but shall not contain the test purposes themselves. The only content of this subclause is the following required text:

[ISO 10303 required]

4.2 AIM test purposes

Test purposes are implicitly derived from the AP AIM EXPRESS, and are not explicitly documented here. AIM test purposes are implicitly derived from the expanded EXPRESS listing contained in annex A of ISO 10303-*<part number of corresponding AP>* as follows:

- AIM entity data types: a test purpose derived from an AIM entity data type is a simple statement of the entity data type name.
- AIM entity attributes: a test purpose derived from an AIM entity attribute is a statement of the AIM entity data type with a given attribute.

AIM test purposes shall be interpreted as given in the following statement: the postprocessor shall accept the input in accordance with the AIM EXPRESS structure corresponding to this test purpose. This implies that the semantics of the application element represented by the AIM element are preserved by the IUT between the input and output of a test according to the reference path specified in the mapping table of the AP. This also implies no violations of any constraints (local rules or global rules) that apply to the AIM element. AIM test purposes apply to the input specifications of postprocessor test cases only.

[end required]

10.7.3 Implementation method test purposes

This subclause shall specify any domain test purposes required in the ATS. Following the subclause heading, describe the source of the domain test purposes and their applicability (preprocessors, postprocessors, or both). Implementation method test purposes shall be preceded by the identifier *other<n>*, where *<n>* is unique in the ATS.

Use the following required text and format in the implementation method test purposes subclause when the implementation method used is ISO 10303-21. If there are no implementation method test purposes, omit this subclause and renumber accordingly.

[ISO 10303 required]

4.3 Implementation method test purposes

The following test purpose is derived from requirements in ISO 10303-21 and applies to preprocessors only.

other1 The IUT correctly encodes the AIM schema name in the exchange structure.

The following test purposes are derived from requirements in ISO 10303-21 and apply to postprocessors only.

other2 The IUT interprets the ISO 10303-21 header section present in the exchange structure.

other3 The IUT interprets the ISO 10303-21 SCOPE and EXPORT constructs present in the exchange structure.

other4 The IUT interprets the ISO 10303-21 user-defined entity constructs present in the exchange structure.

other5 The IUT interprets various representations of numbers present in the exchange structure in accordance with ISO 10303-21.

other6 The IUT interprets various sequences of symbols present in the exchange structure in accordance with ISO 10303-21.

[end required]

10.7.4 Domain test purposes

This subclause shall specify any domain test purposes required in the ATS. Following the subclause heading, describe the source of the domain test purposes and their applicability (preprocessors, postprocessors, or both). Domain test purposes shall be preceded by the identifier other<n>, where <n> is unique in the ATS.

Use the following required heading and format to introduce the domain test purposes subclause. If there are no domain test purposes, omit this subclause.

[ISO 10303 required]

4.4 Domain test purposes

The following test purposes are intended to test for <description>. They apply to <types of processors>.

other<q> <specification of other test purpose>

other<r> <specification of other test purpose>

...

[end required]

10.7.5 Other test purposes

This subclause shall specify any other types of test purposes required in the ATS. Following the subclause heading, describe the source of the other test purposes and their applicability (preprocessors, postprocessors, or both). Other test purposes shall be preceded by the identifier other<n>, where <n> is unique in the ATS.

Use the following required heading and format to introduce the domain test purposes subclause. If there are no other test purposes, omit this subclause.

[ISO 10303 required]

4.5 Other test purposes

The following test purposes are intended to test for <description>. They apply to <types of processors>.

other<x> <specification of other test purpose>

other<y> <specification of other test purpose>

...

[end required]

10.8 Documentation of general test purposes and verdict criteria

General test purposes are developed from requirements that may be implicit in the test purposes of clause 4. General verdict criteria are associated with general test purposes and apply to all abstract test cases, all preprocessor abstract test cases, or all postprocessor abstract test cases. Verdict criteria shall be presented as statements that evaluate to pass, fail, inconclusive. Use the following required text and format to introduce the general test purposes and verdict criteria clause.

[ISO 10303 required]

5 General test purposes and verdict criteria

General test purposes are statements of requirements that apply to all abstract test cases, all preprocessor abstract test cases, or all postprocessor abstract test cases. General verdict criteria are the means for evaluating whether the general test purposes are met. General verdict criteria shall be evaluated as a part of every executable test case to which they apply. Each general verdict criterion includes a reference to its associated test purpose.

[end required]

10.8.1 General test purposes

Use the following required text and format to introduce the general test purposes subclause. The list may be supplemented with other general test purposes deemed necessary by the ATS developers. General test purposes shall be preceded by the identifier g<n>, where <n> is unique in the ATS.

[ISO 10303 required]

5.1 General test purposes

The following are the general test purposes for this part of ISO 10303:

g1 The output of an IUT shall preserve all the semantics defined by the input model according to the reference paths specified in the mapping table defined in clause 5 of ISO 10303-*<part number of corresponding AP>*.

g2 The output of a preprocessor shall conform to the implementation method to which the IUT claims conformance.

g3 The instances in the output of a preprocessor shall be encoded according to the mapping table and the AIM EXPRESS long form defined in annex A and 5.1 of ISO 10303-*<part number of corresponding AP>*, 5.1 and annex A.

g4 A postprocessor shall accept input data that is encoded according to the implementation method to which the IUT claims conformance.

g5 A postprocessor shall accept input data structured according to the AIM EXPRESS long form and the mapping table as defined in ISO 10303-*<part number of corresponding AP>*, 5.1.

<additional general test purposes as required>

[end required]

10.8.2 General verdict criteria for all abstract test cases

Use the following required text and format to introduce the general verdict criteria for all abstract test cases subclause. This list may be supplemented with other general verdict criteria that apply to every abstract test case. General verdict criteria shall be preceded by the identifier gvc*<n>*, where *<n>* is unique in the ATS.

[ISO 10303 required]

5.2 General verdict criteria for all abstract test cases

The following verdict criteria apply to all abstract test cases contained in this part of ISO 10303:

gvc1 The semantics of the input model are preserved in the output of the IUT according to the reference paths specified in the mapping table defined in ISO 10303-*<part number>*, clause 5 (g1).

<additional general verdict criteria as required>

[end required]

10.8.3 General verdict criteria for preprocessor abstract test cases

Use the following required text and format to introduce the general preprocessor verdict criteria subclause. The list may be supplemented with other general preprocessor verdict criteria deemed necessary by the ATS developers. General verdict criteria shall be preceded by the identifier gvc*<n>*, where *<n>* is unique in the ATS.

[ISO 10303 required]

5.3 General verdict criteria for preprocessor abstract test cases

The following verdict criteria apply to all preprocessor abstract test cases contained in this part of ISO 10303:

gvc2 The output of a preprocessor conforms to the implementation method to which the IUT claims conformance (g2).

gvc3 The instances in the output of a preprocessor are encoded according to the AIM EXPRESS long form and mapping table defined in ISO 10303-<part number>, annex A and 5.1 (g3).

<additional preprocessor verdict criteria as required>

[end required]

10.8.4 General verdict criteria for postprocessor abstract test cases

Use the following required text and format to introduce the general postprocessor verdict criteria sub-clause. The list may be supplemented with other general postprocessor verdict criteria deemed necessary by the ATS developers. General verdict criteria shall be preceded by the identifier gvc<n>, where <n> is unique in the ATS.

[ISO 10303 required]

5.4 General verdict criteria for postprocessor abstract test cases

The following verdict criteria apply to all postprocessor abstract test cases contained in this part of ISO 10303:

gvc4 The postprocessor accepts input data that is encoded according to the implementation method to which the IUT claims conformance (g4).

gvc5 The postprocessor accepts input data that is structured according to the AIM EXPRESS long form and mapping table defined in ISO 10303-<part number>, annex A and 5.1 (g5).

<additional postprocessor verdict criteria as required>

[end required]

10.9 Documentation of abstract test cases

The following required text and format shall introduce the abstract test cases clause.

[ISO 10303 required]

6 Abstract test cases

This clause specifies the abstract test cases for this part of ISO 10303. Each abstract test case addresses one or more test purposes explicitly or implicitly specified in clause 4.

The abstract test cases are organized by <add the appropriate explanation of the abstract test case organization here>. The title for an abstract test case signifies <add the significance of or reasoning behind the individual titles.>. All abstract test case names are unique within this part of ISO 10303.

Each abstract test case has a subclause for the preprocessor test information and a subclause for each postprocessor input specification and related test information. The preprocessor and postprocessor input specifications are mirror images of each other: they represent the same semantic information. The preprocessor input model is presented in the form of a table with five columns:

- The Id column contains an identifier for the application object instantiated in a particular row. The identifier may be referenced as the value of an application assertion. The identifier is the lowest-level subclause number from ISO 10303-<part number of corresponding AP>, 4.2 where the application element that appears in that row of the table is specified.
- The V column specifies whether or not the element in that row of the table is assigned a verdict in this test case. A blank indicates it is not assigned a verdict in this test case. A ‘*’ indicates that it is assigned a verdict using a derived verdict criteria. The derived verdict criteria determine whether the semantics associated with the application element are preserved in the output of the IUT according to the reference paths specified in the mapping table defined in ISO 10303-<part number of corresponding AP>, 5.1. A number in the V column references a specific verdict criterion defined in the verdict criteria section that follows the preprocessor input specification table.
- The Application Elements column identifies the particular application element instance that is being defined by the table. For assertions the role is specified in parenthesis.
- The Value column specifies a specific value for the application element. For application objects and attributes the value column defines the semantic value for that element’s instance in the input model. A “#<number>” in the column is a reference to an entity instance name in the postprocessor input specification where the corresponding value is specified. For assertions, this column holds a link to the related application object. A “<not_present>” indicates that the application element is not present in the input model.
- The Req column specifies whether the value in the Value column is mandatory (M), suggested (S) or constrained (C<n>) where ‘n’ is an integer referencing a note that follows the table. A suggested value may be changed by a test realizer. A mandatory value may not be changed due to rules in EXPRESS, rules in the mapping table, or the requirements of the test purpose being assigned a verdict. Each constrained value references a note labelled C<number> at the end of the preprocessor input model table and may be modified according to specific constraints specified in it.

The postprocessor input specifications are defined using ISO 10303-<part number of corresponding AP>. The values in the postprocessor specifications are suggested unless declared mandatory or constrained by the preprocessor input table.

The abstract test case identifies all the verdict criteria that are used to assign a verdict during testing. Specific verdict criteria for preprocessor and postprocessor testing are defined explicitly in each abstract test case subclause. The relevant derived verdict criteria for preprocessor and postprocessor testing are identified in the V column of the preprocessor input table.

[end required]

10.9.1 Abstract test cases

Each abstract test case shall be documented as a separate subclause of the abstract test suite part. Each abstract test case also contains a unique name within the abstract test suite. Each abstract test case shall contain at the top level, a test case summary that consists of several sentences describing the scope of the test case. If there are any other details that apply to the test case as a whole such as execution sequence or other details, they are recorded in subsequent paragraphs within this subclause.

The first abstract test case is documented in subclause 6.1 and the numbering continues sequentially. The title of each abstract test case subclause shall be the title of the test case. Each abstract test case subclause shall contain the following:

- A test case summary that is composed of two to three sentences about the general purpose of the particular abstract test case.
- An optional paragraph that specifies details about the sequence of operations required for performing this test.
- Optional text (one or more paragraphs) that specifies information that is necessary for the abstract test case but for which there is no specified place for documentation.

10.9.1.1 Preprocessor test cases

Each abstract test case contains one preprocessor test case. The preprocessor test case has the following mandatory subclauses:

- Vest purposes covered;
- Input specification;
- Verdict criteria.

The test case may also contain the following optional subclauses:

- Constraints on values;
- Execution sequence;
- Extra details.

Each preprocessor test case subclause contains the following required text and format.

[ISO 10303 required]

6.1.1 Preprocessor

6.1.1.1 Test purposes covered

In the preprocessor input specification table of this test case, the numbers in the Id column (ignoring the part beyond the decimal point, if any) whose rows are not empty in the V column identify the application objects that are covered by this test case. These Id numbers refer directly to the subclause numbers within ISO 10303-<part number of corresponding application protocol>, 4.2, where the application object is defined.

The following general test purposes are covered: g1, g2, and g3 <add other general test purposes as appropriate>.

[end required]

If other test purposes are covered by this preprocessor test case add the following text:

[ISO 10303 required]

The following other test purposes are covered: <list the other test purpose identifiers here separated by commas>.

[end required]

Each preprocessor input specification shall be presented as a table (see 4.4.2, noting particularly the requirements for multipage tables in 4.4.2.3 and for repetition of column headings in 4.4.2.5). The requirements for format and layout of tables described in 5.3.4 also apply. The title of the subclause specifying the input specification shall be “Input specification”. The title shall be “Application elements for <abstract test case title>”.

EXAMPLE The example below illustrates the required text and format for a preprocessor input specification. The entries in the table are for explanatory purposes only. Populate the table according to the Guidelines for the development of abstract test suites, 2nd edition.

6.1.1.4 Input specification

Table <n> - Application elements for <abstract test case title>

Id	V	Application Elements	Value	Req
@1	*	Application_object1	#20	M
		Application_object1.attribute1	#20, "Value of attribute1"	S
	<x>	Application_object1.attribute2	#30	S
	*	Application_object1 to Application_object2 (role)	@100.2	M
		Application_object3 to Application_object1 (inv-role)	@200	M
@100	*	Application_object2	#1190	M
	*	Application_object2.attribute1	#1200	C1
@100.2	*	Application_object2	#190	M
	*	Application_object2.attribute1	#200, <Figure 1>	C<z>
	*	Application_object1 to Application_object2 (inv-role)	@1	M
@200	*	Application_object3	#555	M
	*	Application_object3 to Application_object1 (role)	@1	M

Any supporting material (such as figures) should be included immediately following the table.

The remaining subclauses for a preprocessor text case shall be presenting using the following format and content:

[ISO 10303 required:]

6.1.1.3 Verdict criteria

The following general verdict criteria apply: <list general verdict criteria identifiers, separated by commas>.

The verdict criteria derivable from the application elements with non-blank entries in the V column of the preprocessor input specification table apply.

The following preprocessor-specific verdict criteria apply:

vc<x> <specific verdict criteria>

vc<y> <specific verdict criteria>

6.1.1.4 Constraints on values

The following constraints apply as referenced in the input specification table:

c<z> <describe any special constraints on changing the value of an application element in the input specification>

[end required]

If there are no constraints on values this subclause shall be omitted.

The remaining elements of the test case specification are optional:

- a subclause titled “Execution sequence” that specifies details about the sequence of operations required for performing this preprocessor test;
- a subclause titled “Extra details” that specifies any additional information that is necessary to the preprocessor abstract test case but for which there is no specified place for documentation.

10.9.1.2 Postprocessor test cases

Each abstract test case contains one or more postprocessor test case. The postprocessor test case has the following mandatory subclauses:

- Test purposes covered;
- Input specification;
- Verdict criteria.

The test case may also contain the following optional subclauses:

- Execution sequence;
- Extra details.

Each postprocessor test case contains the following required text and format.

More than one postprocessor input specification may be required to properly cover the possible range of AIM constructs that could be used to represent the application elements for a particular abstract test

case. Hence there may be more than one postprocessor subclause in a single test case. If there are two or more postprocessor input specifications for an abstract test case, they shall be listed sequentially in separate subclauses, each titled “Postprocessor n” where n is a sequential integer that uniquely identifies the postprocessor input specification within the abstract test case. Each postprocessor subclause is divided into separate sections for the test purposes covered, the postprocessor input specification reference, and the verdict criteria. When there is only one postprocessor input specification in the abstract test case, the sequential integer shall be dropped.

[ISO 10303 required]

6.1.2 Postprocessor

6.1.2.1 Test purpose coverage

The following general test purposes are covered: g1, g4, and g5 <add other general test purposes as appropriate>.

[end required]

If other test purposes are covered by this postprocessor test case add the following text:

[ISO 10303 required]

The following other test purposes are covered: <list the other test purpose identifiers here separated by commas>.

[end required]

Continue the postprocessor test case specification as follows:

[ISO 10303 required]

In the preprocessor input specification table of this test case, the numbers in the Id column (ignoring the part beyond the decimal point, if any) whose rows are not empty in the V column identify the application objects that are covered by this test case. These Id numbers refer directly to the subclause numbers in ISO 10303-*<part number of corresponding AP>*, 4.2 where the application object is defined.

6.1.2.2 Input specification

The postprocessor input specification is provided in electronic form only. See annex C.

6.1.2.3 Verdict criteria

The following general verdict criteria apply: *<list general verdict criteria identifiers, separated by commas>*.

The verdict criteria derivable from the application elements with non-blank entries in the V column of the preprocessor input specification table apply.

The following specific verdict criteria apply:

vc<x> <specific verdict criteria>

vc<y> <specific verdict criteria>

[end required]

The remaining elements of the test case specification are optional:

- a subclause titled “Execution sequence” that specifies details about the sequence of operations required for performing this postprocessor test;
- a subclause titled “Extra details” that specifies any additional information that is necessary to the postprocessor abstract test case but for which there is no specified place for documentation.

10.10 Documentation of annexes

The required annexes of an ATS are as follows:

- Conformance classes (normative);
- Computer interpretable postprocessor input specification (normative);
- Information object registration (normative).

Annexes with the following title may be included in the ATS if appropriate:

- Usage scenarios (informative).

10.10.1 Conformance classes (annex A)

Annex A is a required normative annex that shall contain lists that show which abstract test cases are required to be executed for each conformance class of the AP. For an AP with conformance classes, a

subclause of the annex shall be provided for each conformance class. Each subclause shall be of the following form with the appropriate substitutions of numbers:

[ISO 10303 required]

A.1 Conformance class 1

To conform to conformance class 1 of ISO 10303-<part number of corresponding AP>, an implementation shall pass executable versions of the following abstract test cases:

- <abstract test case identifier>;
- <abstract test case identifier>;
- ...
- <abstract test case identifier>.

[end required]

If the AP does not have any defined conformance classes, the content of this annex reduces to the following statement.

[ISO 10303 required]

Conformance to ISO 10303-<part number of corresponding AP> is defined only in terms of the entire AP. Therefore, conformance requires that an implementation pass executable versions of all abstract test cases in clause 6.

[end required]

10.10.2 Computer interpretable postprocessor input specification (annex B)

Annex B shall provide electronic access to the postprocessor input specifications for this part. This access is provided through the specification of URLs that identify the location of these files on the Internet.

Use the following text and format for documenting this annex. In the URL for the postprocessor input specification, replace “nnn” in “partnnn” with the number of this part of ISO 10303 and “is” with the stage of the part. Confirm the URL with the SC4 Secretariat prior to publication.

[ISO 10303 required]

This annex references a listing of the postprocessor input specifications for this part of ISO 10303 without comments or other explanatory text. These specifications are documented using ISO 10303-
<21 or 12>. These specifications are available in computer-interpretable form and can be found at the following URL:

<http://www.mel.nist.gov/step/parts/partnnn/is/>

If there is difficulty accessing this site contact the ISO Central Secretariat or contact the ISO TC 184/SC4 Secretariat directly at: sc4sec@cme.nist.gov.

The postprocessor input specifications for each test case is supplied electronically via the Internet. Table C.1 lists the file name of the postprocessor input specification that is associated with the post-processor subclause(s) of a test case.

[end required]

This text is followed by a table that identifies the files containing each postprocessor input specification, using the following format:

[ISO 10303 required]

Table B.1 — Postprocessor input specification file names

Subclause	Test case	File name
6.1.2	<Test_case_name>	<filename>
...
6.x.x	<Test_case_name>	<filename>

[end required]

10.10.3 Information object registration (annex C)

Each ATS shall include an annex giving information object identifiers as defined in ISO/IEC 8824-1. See annex B for details of the required contents of this annex of the ATS.

10.10.3.1 Usage scenarios (annex D)

AP usage scenarios used to develop abstract test cases may be provided in an informative annex. If provided, they shall follow the format used to prepare the other annexes.

11 Documentation of the application module series of parts of ISO 10303

NOTE Requirements for the documentation of the application module series of parts of ISO 10303 will be added after approval and publication of the relevant guidelines [14] and [17].

12 Documentation of the parts of ISO 13584

NOTE Requirements for the documentation of the parts of ISO 13584 will be included as and when they are provided by the project(s) responsible for this standard.

13 Documentation of the parts of ISO 15531

NOTE Requirements for the documentation of the parts of ISO 15531 will be included as and when they are provided by the project(s) responsible for this standard.

14 Documentation of the parts of ISO 15926

NOTE Requirements for the documentation of the parts of ISO 15926 will be included as and when they are provided by the project(s) responsible for this standard.

15 Documentation of the parts of ISO 18629

NOTE Requirements for the documentation of the parts of ISO 18629 will be included as and when they are provided by the project(s) responsible for this standard.

16 Documentation of the parts of ISO 18876

NOTE Requirements for the documentation of the parts of ISO 18876 will be included as and when they are provided by the project(s) responsible for this standard.

17 Documentation of standards that are produced jointly with other committees

NOTE Requirements for the documentation of standards that are produced jointly with other committees will be included as and when they are provided by the project(s) responsible for such standards.

Annex A

(normative)

Cover page

The cover page shall be completed in full for all parts of ISO 10303. A sample cover page follows this page. A cover page with similar content and appearance shall be used on all TC 184/SC4 documents.

An electronic version of the cover page is located on SOLIS in the sc4/editing/cover directory. That directory also includes a readme file that gives instructions for completing the cover page. Be sure to access the readme file before filling out the cover page.

ISO TC184/SC4/WG__ N____

Date: yyyy-mm-dd

Supersedes ISO TC184/SC4/WG__ N____

ISO/[ballot stage] [standard number]-[part number].[ballot cycle]

Standard title: Series title: Part title

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ABSTRACT**KEYWORDS:****COMMENTS TO READER:****Project Leader:****Address:****Telephone:****Facsimile:****E-mail:****Part Editor:****Address:****Telephone:****Facsimile:****E-mail:**

Annex B (normative)

Use of ASN.1 Identifiers in SC4 standards

B.1 Information object registration annex

All parts of SC4 standards shall have at least one normative annex. This annex defines the information object identifier for the part as specified by ISO/IEC 8824-1. In ISO 10303 (which has been granted an exception to the ID3 ordering rules for annexes) this annex is the last normative annex. As a consequence, all parts of SC4 standards shall specify a normative reference to ISO/IEC 8824-1.

The structure of the annex in which the information object registration is specified varies according to the nature of the part. In a part of an SC4 standard that includes one or more EXPRESS schemas, the annex has two subclauses: Document identification and Schema identification. In a part that does not include EXPRESS schemas, there is no subdivision; the content of the annex corresponds to that of the Document identification subclause in the first case.

B.1.1 Document identification

Use the following text to introduce the document identification for all standards prepared by SC4:

[ISO 10303 required]

To provide for unambiguous identification of an information object in an open system, the object identifier

```
{ iso standard <sssss> part(<ppp>) version(<v>) }
```

is assigned to this part of ISO sssss. The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO 10303-1.

[end required]

NOTE In a part that includes one or more EXPRESS schemas, place this text in a subclause titled “Document identification”. In other parts, place this text after the annex heading.

As illustrated above, centre the object identifier and use the same font as is used for EXPRESS code.

In the preceding text the following variable definitions apply:

<sssss>: the integer identifier for the ISO standard number. This identifier does not include the part number of the standard.

EXAMPLE 1 <sssss> for STEP is 10303.

<ppp>: the integer identifier for the part number of the ISO standard.

EXAMPLE 2 <ppp> for ISO 10303-41 is 41.

<v>: the integer identifier for the version of the standard. The version number of the first edition of the standard shall be 1; subsequent modifications of the standard, whether by way of corrigenda, amendments or new editions shall have version numbers one larger than the previous versions.

EXAMPLE 3 The first edition of ISO 10303-41 has the version number 1. A technical corrigendum to the first edition results in a version number of 2. The second edition of ISO 10303-41 will have a version number of 3.

When a technical corrigendum or amendment to a standard is published, include a change to its base document that provides for an incremented version number. This change shall be reported as a change to the Object Information registration annex.

B.1.2 Schema identification

For all parts of SC4 standards that define schemas, include a subclause titled “Schema identification” within the information object registration annex. If the part includes more than one EXPRESS schema, further subdivide this subclause such that each subdivision identifies one schema. Order these subclauses in the same sequence as the schemas themselves. If the part includes one schema, use the text given below within the “Schema identification” subclause.

For each schema, use the following text:

[ISO 10303 required]

To provide for unambiguous identification of the schema-name in an open information system, the object identifier

```
{ iso standard <sssss> part(<ppp>) version(<v>) schema(1) <schema-
                                name>(<nn>) }
```

is assigned to the **<schema_name>** schema (see clause <r>). The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO 10303-1.

[end required]

In the preceding text the following variable definitions apply:

<sssss>: the integer identifier for the ISO standard number. This identifier does not include the part number of the standard.

EXAMPLE 1 <sssss> for STEP is 10303.

<ppp>: the integer identifier for the part number of the ISO standard.

EXAMPLE 2 <ppp> for ISO 10303-41 is 41.

<v>: the integer identifier for the version of the schema, The version number of the first version of the schema shall be 1; subsequent modifications of the schema, whether by way of corrigenda, amendments or new editions shall have version numbers one larger than the previous versions.

If the schema is unchanged from the schema in a previous version, its version number shall be unchanged. Otherwise, its version number shall be incremented.

schema: the integer identifier of the type of information object in the standard. The value 1 identifies the object as a schema. At the time of publication of this document, no other values have been assigned. In the future, SC 4 may assign other values of this field to identify other information objects, such as entities, defined types, or conformance classes.

NOTE If further information object type identifiers are to be defined, consult with the Quality Committee for an object type number and follow a similar form as that used for schemas.

<schema-name>: name of the schema in which all occurrences of underscore (_) have been replaced by hyphen (-).

<nn>: an integer number that has been assigned to the schema. In the first version of a standard, these numbers shall be assigned sequentially to the schemas, from 1 to m. In subsequent versions of the standard, (whether through corrigenda, amendments or new editions) existing or modified schemas shall preserve this integer identifier. New schemas shall be assigned new values of the integer that have not been previously assigned. If schemas from previous versions of a standard are deleted from the standard, the values of this integer shall not be reassigned.

EXAMPLE 3 Technical Corrigendum 1 to standard part nn (which contains two schemas S1 and S2), amends schema S1 but leaves schema S2 unchanged. The Technical Corrigendum amends the schema identifiers such that the version number of S1 is incremented (2) and that for S2 is unchanged (1).

EXAMPLE 4 The first edition of ISO 10303-49 has several schemas. The third schema is the process_property_representation_schema. The schema identifier is

```
{ iso standard 10303 part(49) version(1) schema(1)
  process-property-representation-schema(3) }
```

EXAMPLE 5 ISO 10303-49 Technical Corrigendum 1 is issued and the technical corrigendum modifies the EXPRESS schema in the process_property_representation_schema. The ISO 10303-49 Technical Corrigendum 1 contains statements that modify some object identifiers in Annex B. In B.1, the TC changes the object identifier to

```
{ iso standard 10303 part(49) version(2) }
```

In B.2.3, the TC changes the object identifier to

```
{ iso standard 10303 part(49) version(2) schema(1)
  process-property-representation-schema(3) }
```

The other object identifiers in ISO 10303-49 are not affected.

B.2 Tutorial

B.2.1 Introduction

SC4 uses three separate terms to manage the various components of its standards. These terms are:

- edition,
- version, and
- release.

The term “edition” identifies a published document. The method of identifying the edition is by the year of publication. Thus, we refer to Part 21 as ISO 10303-21:1994. When a second edition of Part 21 is published, its identifier will differ by the year of its publication.

The term “version” identifies the normative content of a standard. For the initial edition of each part of an SC4 standard, there is a one to one correspondence between the edition and the version. However, if Technical Corrigenda or Amendments to the standard are published, the version of the technical content changes. In general, there is not a simple relationship between edition and version. The version is meant to identify the technical content to which conformance may be claimed.

For example, because the published version of Part 21 contained technical errors, it was necessary to issue a Technical Corrigendum to this part. The version of the original publication is 1; the version of effective standard, after applying the Technical Corrigendum is 2. Note that version 2 of Part 21 is documented in the two publications, the IS of Part 21, and the TC to Part 21, and not just a single document. Similarly, if an amendment to Part 21 is adopted, the version of the effective standard will be 3, and will be documented in the three publications taken together.

The version is defined as part of the Object Identifier defined in an Annex of each part of each SC4 standard. The value of that object identifier is described below.

The term “release” is used by SC4 to manage the publications of groups of parts; historically, this has been primarily applied to ISO 10303, although future planning for SC4 standards includes releases that comprise parts of several standards. The release is not explicitly defined within any part of a standard. It is used solely for managing the development of STEP.

B.2.2 Object Identifiers

An Object Identifier is a primitive data type defined in ASN.1, ISO/IEC 8824-1. The value identifies a node in a tree structure by providing a sequence of (positive) integers each of which identifies a link in the tree. The notation used in SC4 is the value notation defined in ISO/IEC 8824.

The syntax of this value notation is a sequence of node specifiers enclosed in braces (curly brackets) and separated by spaces. The syntax of each node specifier is:

- a number,
- a symbol, or
- a symbol followed by a number in parenthesis.

Whichever syntax is chosen, the resulting value must reduce to a sequence of integers. These choices are described below.

- A number. This is self identifying; the value of the node identifier is the value of the number. Any object identifier can optionally be written as a series of numbers. See the example below.
- A symbol. This syntax can be used only for the first or second node, and the only symbols that may be used are those defined in the annexes of ISO/IEC 8824-1. For our purposes, this means that the first part of all object identifiers must be:

{ iso standard }

which is equivalent to the object identifier

{ 1 0 }

- A symbol followed by a number in parenthesis. If this form is used, the value of the node is the value of the number. The symbol is a local variable that is automatically assigned the value of the number. Because there are no other uses for this symbol in the syntax, the only utility of this form is to give a human readable idea of the meaning of the node. Thus, we will use “version(1)” to indicate that we are dealing with the first version of something. We can equally refer to this node as “1”. Both forms evaluate to 1; the first form associates the semantics of “version” with this value.

The lexical syntax of terms in the object identifier is similar to that of EXPRESS, except that occurrences of underscore (_) shall be replaced by hyphen (-).

In the annexes, ISO/IEC 8824-1 defines the four topmost levels of all object identifiers. In particular, it defines the form

$$\{ 1 \ 0 \ n \ nn \}$$

to be an object identifier that identifies an ISO standard number "n", part "nn". It then provides for the committee or subcommittee that wrote the standard to assign other nodes beneath this for identifying information objects related to this standard. Note that this identifier can also be written:

$$\{ \text{iso standard } n \text{ part}(nn) \}$$

which is closer to the form we normally use. In this notation, the defined symbol "iso" has the value 1, and the defined symbol "standard" has the value 0.

To repeat, ISO (in ISO/IEC 8824-1) defines the interpretation of the nodes at the first four positions of these object identifiers. The subcommittee writing the standard (in this case, SC4) controls the semantics of nodes at lower positions.

SC4 has decided to associate the fifth node with the version of the information object being identified. This means that a standard form of the object identifier for the (part of the) standard considered as a whole is

$$\{ \text{iso standard } 10303 \text{ part}(nn) \text{ version}(v) \}$$

SC4 has adopted the convention that the sixth node identifies an object type, and the succeeding node or nodes identify a specific instance of that object type. The initial release defined only a single value for the object type; object(1) indicates that the object being identified is a schema. In the future, SC 4 may define other values for this node to cover other information objects such as entities, defined types, conformance classes, or parts libraries. Values of object of 2 and greater are available for this purpose when the need arises. As of today, however, the only valid value of the sixth node is 1.

As corrigenda or amendments to the standards or new editions of the standards are published, the version number of the total content of the standard shall be increased by one to reflect the new content. It may be that in adopting a new edition of some standard, some information objects (schemas) within the standard will be unchanged from the previous versions. In this case the object identifier that identifies that information object (schema) should be the same as in the previous version of the standard, indicating that that particular item (schema) is unchanged.

Annex C (informative)

Examples

C.1 Documentation of an EXPRESS ARM

This example illustrates the required documentation for ISO 10303 application protocol ARMs that are defined in EXPRESS-G (see 9.6.4). The sample documentation that follows is based on the ARM EXPRESS-G diagram shown in Figure C.1.

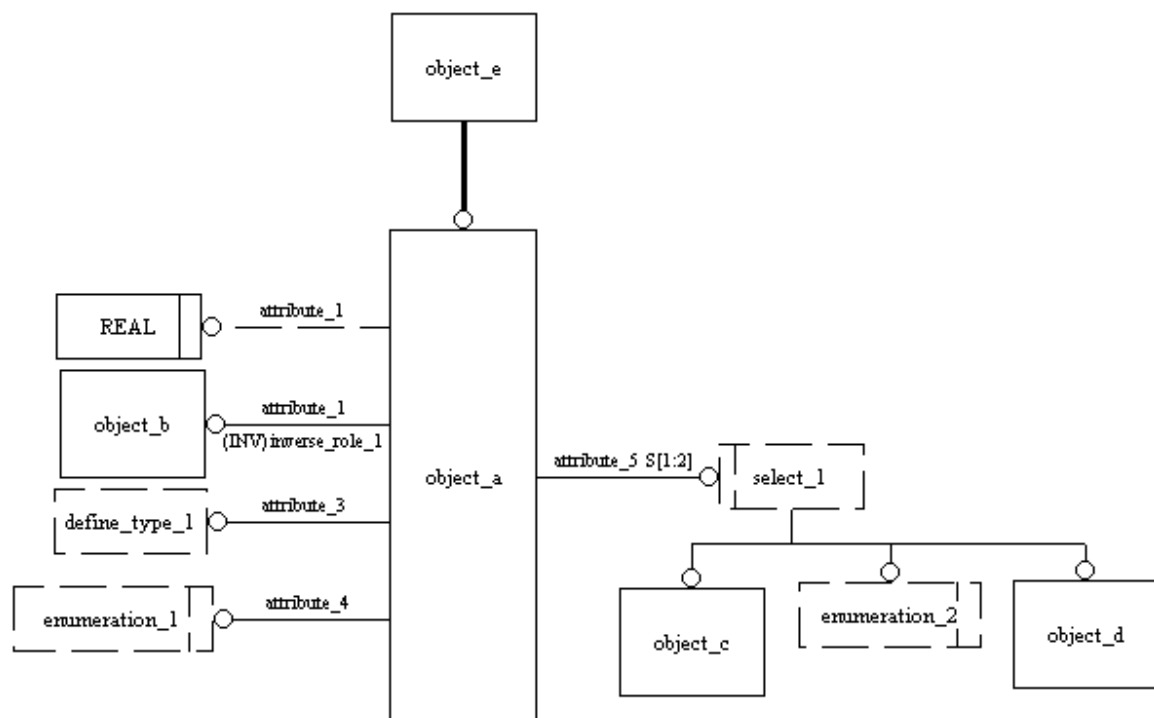


Figure C.1 — ARM diagram 1 of 1 in EXPRESS-G

4.2.1 Object_a

An Object_a is a type of Object_e (see 4.2.5) that is <definition>. The data associated with an Object_a are the following:

- attribute_1;
- attribute_2;
- attribute_3;
- attribute_4;
- attribute_5.

4.2.1.1 attribute_1

The attribute_1 specifies <definition>. The attribute_1 need not be specified for a particular Object_a.

4.2.1.2 attribute_2

The attribute_2 specifies <context or role within object>. See 4.3.1 for the application assertion.

4.2.1.3 attribute_3

The attribute_3 specifies <define type definition>.

4.2.1.4 attribute_4

The attribute_4 specifies <definition>. The value of attribute_4 is one of the following:

— type_1;

— type_2.

NOTE See 4.2.1.4.1 and 4.2.1.4.2 for the definition of each allowable value for attribute_4.

4.2.1.4.1 type_1

type_1: <definition>.

4.2.1.4.2 type_2

type_2: <definition>.

4.2.1.5 attribute_5

The attribute_5 specifies <definition>. Each attribute_5 may be one of the following: object_c (see 4.2.3), object_d (see 4.2.4). See 4.3.2 and 4.3.3 for the application assertion. Or the value of attribute_5 shall be one of the following:

— type_3;

— type_4.

NOTE See 4.2.1.5.1 and 4.2.1.5.2 for the definition of each allowable value for attribute_5.

4.2.1.5.1 type_3

type_3: <definition>.

4.2.1.5.2 type_4

type_4: <definition>.

4.2.2 Object_b

An Object_b is <definition>.

4.2.3 Object_c

An Object_c is <definition>.

4.2.4 Object_d

An Object_d is <definition>.

4.2.5 Object_e

An Object_e is <definition>. An Object_e may be an Object_a (see 4.2.1).

4.3 Application assertions**4.3.1 Object_a to Object_b**

Object_a has attribute_2 defined by exactly one Object_b. Object_b defines inverse_role_1 for exactly one Object_a.

4.3.2 Object_a to Object_c

Object_a has attribute_5 defined by one or two Object_c objects. Object_c defines attribute_5 for zero, one, or many Object_a objects.

4.3.3 Object_a to Object_d

Object_a has attribute_5 defined by one or two Object_d objects. Object_d defines attribute_5 for zero, one, or many Object_a objects.

C.2 Example mapping specification

The following example presents a fragment of a mapping specification (based on the mapping table of ISO 10303-201) that illustrates the requirements described in 9.7.1.

5.1 Mapping specification**5.1.1 Example UOF****5.1.1.1 Approval**

AIM element: product

Source: 41

5.1.1.1.1 Date

AIM element: calendar_date

Source: 41

Reference path: approval <-
 approval_date_time.dated_approval
 approval_date_time
 approval_date_time.date_time ->
 date_time_select
 date_time_select = date
 date =>
 calendar_date

5.1.1.1.2 Description

AIM element: approval.level

Source: 41

5.1.1.1.3 approval to organization

#1: If the approval is given by only a person

#2: If the approval is given by only an organization

#3: If the approval is given by a person within an organization

AIM element: PATH

Reference path: approval <-
 approval_person_organization.authorized_approval
 approval_person_organization
 approval_person_organization.person_organization ->
 person_organization_select
 #1 (person_organization_select = person
 person)
 #2 (person_organization_select = organization
 organization)
 #3 (person_organization_select = person_and_organization
 person_and_organization)

5.1.1.2 Drawing

AIM element: draughting_drawing_revision

Source: 201

Reference path: draughting_drawing_revision <=
 drawing_revision

5.1.1.2.1 drawing_number

AIM element: drawing_definition.drawing_number

Source: 101

Reference path: draughting_drawing_revision <=
 drawing_revision
 drawing_revision.drawing_identifier ->
 drawing_definition
 drawing_definition.drawing_number

C.3 Example entity data type declaration

This example illustrates the required documentation for entity data types (see 6.4.9).

x.x.x foo

A **foo** is xxxxxxxxxxxxxxxxxxxx xx

EXPRESS specification:

```
*)
ENTITY foo;
    first  : INTEGER;
    second : REAL;
UNIQUE
    UR1: first,second;
WHERE
    WR1: first > 2;
END_ENTITY;
(*
```

Attribute definitions:

first: xxxxxxxxxxxxxxxxxxxx

second: xxxxxxxxxxxxxxxx

Formal propositions:

UR1: xxxxxxxxxxxxxxxxxxxxxxxxx

WR1: xxxxxxxxxxxxxxxxxxxxxxxxxx

Informal propositions:

[illegible]

C.4 Sample table of contents

The example on the following two pages illustrates the layout and content of the table of contents of a typical ISO 10303 part (ISO 10303-43 second edition). Note that the headers and footers on these pages are those of this document, not of that from which the example is taken (in which these are pages iii and iv). The page numbers listed in the sample table of contents are those of the source document.

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C.5 Sample foreword of an International Standard

The example on the following page illustrates the layout and content of the foreword of a typical ISO 10303 part that is published as an International Standard (ISO 10303-43 second edition). Note that the headers and footers on the sample page are those of this document, not of that from which the example is taken (in which this is page v).

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 10303 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 10303-43 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data*.

This second edition of ISO 10303-43 constitutes a technical revision of the first edition (ISO 10303-43:1994), which is provisionally retained to support continued use and maintenance of implementations based on the first edition, and to satisfy the normative references of other parts of ISO 10303. This edition incorporates the corrections published in ISO 10303-43:1994/Cor.1:1999 and ISO 10303-43:1994/Cor.2:2000.

This International Standard is organized as a series of parts, each published separately. The structure of this International Standard is described in ISO 10303-1.

Each part of this International Standard is a member of one of the following series: description methods, implementation methods, conformance testing methodology and framework, integrated generic resources, integrated application resources, application protocols, abstract test suites, application interpreted constructs, and application modules. This part is a member of the integrated generic resources series. The integrated generic resources and the integrated application resources specify a single conceptual product data model.

A complete list of parts of ISO 10303 is available from the Internet:

`<http://www.nist.gov/sc4/editing/step/titles/>`

Annexes A and B form a normative part of this part of ISO 10303. Annexes C and D are for information only.

C.6 Sample foreword of a Technical Specification

The example on the following page illustrates the layout and content of the foreword of an SC4 standard that is to be published as a Technical Specification (ISO/CD TS 18876-2). Note that the headers and footers on the sample page are those of this document, not of that from which the example is taken (in which this is page v).

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed every three years with a view to deciding whether it can be transformed into an International Standard.

Attention is drawn to the possibility that some of the elements of this part of ISO 18876 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TS 18876-1 was prepared by Technical Committee ISO/TC184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data*.

This International Standard is organized as a series of parts, each published separately. The structure of this International Standard is described in this part of ISO 18876.

A complete list of parts of ISO 18876 is available from the Internet:

`<http://www.iso18876.org/parts.html>`

Annex A forms a normative part of this part of ISO 18876.

Annex D (informative)

Criteria for lexical definitions

Definitions of terms (as presented in clause 3 of a standard – see 4.2.5 of this standing document) are required to conform to the provisions of the ISO/IEC Directives Part 3 and of ISO 10241:1992. The following additional recommended practices are from *A Concise Introduction to Logic* by Patrick J. Hurley [9].

“Because the function of a lexical definition is to report the way a word is actually used in a language, lexical definitions are the ones we most frequently encounter and are what most people mean when they speak of the ‘definition’ of a word. Accordingly, it is appropriate that we have a set of rules that we may use in constructing lexical definitions of our own and in evaluating the lexical definitions of others.”

Rule 1: A lexical definition should conform to the standards of proper grammar.

Rule 2: A lexical definition should convey the essential meaning of the word being defined.

The aspects mentioned in the definition should be the important or necessary features of the thing defined, not trivial ones.

Rule 3: A lexical definition should be neither too broad nor too narrow.

A definition is too broad if the definition applies to things other than the things that are being defined.

Rule 4: A lexical definition must not be circular.

A circular definition uses the definiendum in some way in the definition and is thus not genuinely informative.

Rule 5: A lexical definition should not be negative when it can be affirmative.

Rule 6: A lexical definition should not be expressed in figurative, obscure, vague, or ambiguous language.

A definition is figurative if it involves metaphors or tends to paint a picture instead of exposing the essential meaning of a term. Example: “Architecture means frozen music”. A definition is obscure if its meaning is hidden. One source of obscurity is overly technical language. A definition is vague if its meaning is blurred. A definition is ambiguous if it lends itself to more than one distinct interpretation.

Rule 7: A lexical definition should avoid affective terminology.

Affective terminology is any kind of word usage that plays upon the emotions of the reader or listener.

Rule 8: A lexical definition should indicate the context to which the definition pertains.

This rule applies to any definition in which the context of the definition is important to the meaning of the definiendum. Whenever the definiendum is a word that means different things in different contexts, a reference to the context is important.

Annex E

(informative)

Checklists and approval procedures

This standing document specifies requirements that apply to the standards developed within SC4. In order to confirm that each SC4 standard submitted for ballot or publication satisfies the relevant requirements of this and other standing documents, SC4 has approved a review and approval procedure. This procedure is specified in the SC4 Quality Manual [24], and includes requirements for the completion of the following checklists.

- The internal review checklist [20] is used by a member of the project team (preferably not the project leader or the part editor) to check the part document against the detailed requirements that apply to it. These requirements include many of those specified in this standing document.
- The project leader approval checklist [22] is used by the project leader to check the part document against a sample of the main requirements that apply to it.
- The convener approval checklist [14] is used by the convener of the working group to which the project is assigned to check the part document against a sample of the main requirements that apply to it.

The review and approval procedure requires that the completed checklists are published (as working group N-numbered documents) and that both the project leader and the convener have indicated their approval of the document before it can be submitted for ballot or publication.

Current versions of the checklists are available from the Internet:

<http://www.nist.gov/sc4/www/necsdocs.htm>

Annex F (informative)

Extract from Guide to using the ISO technical programme

The following is taken from an ISO CS document available from:

<http://www.iso.ch/infoe/comm/howtechprog.htm>

F.1 Project references

The status of each project can be seen from its reference number, which is made up of the following components:

- a) Prefix indicating the international standardizing organization with responsibility for the project (such as ISO, IEC, or jointly ISO/IEC).
- b) The prefix will normally also contain an indication of the current stage and document type (for example, ISO/DIS, signifying an ISO draft International Standard, or ISO/IEC CD Guide, signifying a Committee Draft of a future ISO/IEC Guide).
- c) A reference number for the project, which may include a part number, separated by a hyphen from the main number. In most cases, this is the number under which the final approved standard will be published.

In the case of an Amendment or Technical Corrigendum, the reference number is composed of the reference of the parent standard or project, followed by the document type and number of the Amendment or Corrigendum (for example, ISO/IEC 9596-1:1998/CD Cor 1, indicating a Committee Draft of the first corrigendum to ISO/IEC 9596-1:1998)

To indicate the version of a document at a particular stage (for example a third Committee Draft), the reference number of the project is followed by a point and the version number.

F.2 Examples of the principal abbreviations used in the technical programme

The following table gives examples of the principal abbreviations used in the ISO technical programme, together with an indication of the corresponding project stage. See also:

- The stage code chart for an explanation of all stage codes used by ISO ([<http://www.iso.ch/projects/stage.html>](http://www.iso.ch/projects/stage.html)).
- Explanation of the references for the various types of ISO standards and standards-type documents ([<http://www.iso.ch/infoe/howtou.html>](http://www.iso.ch/infoe/howtou.html)).
- The list of abbreviations ([<http://www.iso.ch/infoe/howtou.html#Abbrev>](http://www.iso.ch/infoe/howtou.html#Abbrev)) contained in “Your guide to ISO Online” ([<http://www.iso.ch/infoe/sitemap.htm#Your guide to ISO Online>](http://www.iso.ch/infoe/sitemap.htm#Your%20guide%20to%20ISO%20Online)).

Table F.1 — ISO stages and abbreviations

Stage	Abbreviation		Description
20 Preparatory stage	20.00	AWI AWI Amd AWI TR or TS	Approved Work Item, no working draft yet available. Approved proposal for an Amendment Approved proposal for a Technical Report or a Technical Specification
	20.20	WD WD Amd WD TR or TS	Working Draft Working draft of an Amendment Working draft of a Technical Report or a Technical Specification
30 Committee stage	x	CD CD Amd CD Cor CD TR or TS DTR <i>PD Amd</i>	Committee Draft Committee Draft of an Amendment Committee Draft of a Technical Corrigendum Committee Draft of a Technical Report or a Technical Specification Draft Technical Report <i>Proposed draft amendment</i>
40 Enquiry stage	x	DIS DAmd <i>FCD</i> <i>FPDISP</i>	Draft International Standard Draft Amendment <i>Final Committee Draft</i> <i>Final proposed Draft International Standardized Profile</i>
50 Approval stage	x	FDIS FD Amd PRF PRF Amd PRF TR or TS PRF Suppl	Final Draft International Standard Final draft amendment Proof of a new International Standard Proof of an Amendment Proof of a Technical Report or a Technical Specification Proof of a Supplement
60 Publication stage	x	ISO ISO/TR or TS Amd Cor	International Standard Technical Report or Technical Specification Amendment Technical Corrigendum
NOTE 1 The abbreviations in italics apply only to the projects of ISO/IEC JTC 1.			
NOTE 2 The abbreviations AWI (approved work item) and PRF (proof) do not appear in the <i>ISO/IEC Directives, Part 1: Procedures for the technical work</i> , 1995, but have been added here to reflect the current options. AWI is only used for stage 20.00 (new project registered in TC/SC work programme) and PRF is applied in cases where projects are passing through the approval stage (50) without being subject to a FDIS ballot.			

Annex G (informative)

Revision history

Document	Date	Notes
SC4 N537	1997-03-30	Supplementary directives for the drafting and presentation of ISO 10303 – approved by SC4 for all ISO 10303
SC4 N858	1999-04-29	Draft Supplementary directives for the drafting and presentation of ISO 10303, second edition – submitted for SC4 standing document ballot
SC4 Nxxx	2001-mm-dd	SC4 Supplementary directives — Rules for the structure and drafting of SC4 standards for industrial data

This standing document cancels and replaces the Supplementary directives for the drafting and presentation of ISO 10303 (SC4 N537). It incorporates resolutions to all ballot comments submitted against SC4 N858 together with changes necessary to ensure that the guidance available to SC4 projects is consistent with the requirements of the ISO/IEC Directives, Part 3.

See the introduction to this document for an overview of the changes incorporated in this version.

This SC4 standing document is applicable with immediate effect to all SC4 projects. The requirements specified in clauses 4, 5, and 6 apply to all SC4 standards. The requirements specified in clauses 6, 7, 8, 9, 10, and 11 apply to the different series of parts of ISO 10303. The requirements specified in clause 12 apply to ISO 13584. The requirements specified in clause 13 apply to ISO 15531. The requirements specified in clause 14 apply to ISO 15926. The requirements specified in clause 15 apply to ISO 18629. The requirements specified in clause 16 apply to ISO 18876. The requirements specified in clause 17 apply to standards produced jointly by SC4 and other ISO or IEC technical committees, subcommittees, or working groups.

Parts of ISO 10303 that are at draft international standard (stage 40) or higher at the time of the publication of this standing document may continue to follow the conventions of the Supplementary directives for the drafting and presentation of ISO 10303 [23] with respect to the margins at the top and bottom of pages (see 5.1.1) and the size of font to be used for subclause headings (see 5.1.3).

Projects preparing and submitting documents for Committee Draft ballot (stage 30) or draft international standard ballot (stage 40) need not comply to all requirements of this standing document if this would delay the submission of the document for ballot.

Bibliography

- [1] ISO 999:1996, *Information and documentation — Guidelines for the content, organization and presentation of indexes*.
- [2] *Federal Information Processing Standards Publication 183, Integration Definition for Functional Modeling (IDEF0)*, FIPS PUB 183, National Institute of Standards and Technology, December 1993. Available from the Internet: <<http://www.ietf.com/idef0.html>>.
- [3] *Federal Information Processing Standards Publication 184, Integration Definition for Information Modeling (IDEF1X)*, FIPS PUB 184, National Institute of Standards and Technology, December 1993. Available from the Internet: <<http://www.ietf.com/idef1x.html>>.
- [4] ALRED, G., BRUSAW, C., & OLIU, W. *Handbook of Technical Writing*, 6th edition; New York, St. Martin's, 2000.
- [5] BARNARD FEENEY, Allison; PALMER, Mark (eds). *Procedures for application interpretation* (draft), ISO TC184/SC4/QC N079, 1998-09-23.
- [6] CHALKER, S. & WEINER, E. *The Oxford Dictionary of Grammar*; Oxford, Oxford University Press, 1994.
- [7] FOWLER, H.W.; *The New Fowler's Modern English Usage*, 3rd edition edited by R.W.Burchfield; Oxford, Oxford University Press, 1996.
- [8] GREENBAUM, S. *The Oxford English Grammar*; Oxford, Oxford University Press, 1996.
- [9] HURLEY, Patrick J. *A Concise Introduction to Logic*; Wadsworth, 1999.
- [10] STRUNK, Jr., W. & WHITE, E.B.; *The Elements of Style*; New York, Macmillan Publishing Co, 1979.
- [11] THOMPSON, D, ed. *The Concise Oxford Dictionary of Current English*, 9th edition; Oxford, Clarendon Press, 1995.
- [12] WILLIAMS, J. *Style: Ten Lessons in Clarity and Grace*, 6th edition; New York, Longman, 2000.
- [13] *Application module development points within the application protocol development process*, ISO TC184/SC4/WG10 N319.
- [14] *Convener approval checklist*. ISO TC184/SC4/QC N195, 2001-06-05.
- [15] *Guide for the use of IT in the development and delivery of standards*. Available from the Internet: <<http://www.iso.ch/itsige/guide/200-Title.html>>.
- [16] *Guidelines for the content of application modules*, ISO TC184/SC4 N1112.
- [17] *Guidelines for the content of application protocols that use application modules*, ISO TC184/SC4 N1113.
- [18] *Guidelines for the development of abstract test suites*, edition 2. ISO TC184/SC4 draft standing document, N873, 1999-08-10.

- [19] *Guidelines for the development of mapping specifications*. ISO/TC 184/SC4 draft standing document, N1029, 2000-04-20.
- [20] *Internal review checklist*. ISO TC184/SC4/QC N193, 2001-06-05.
- [21] *Procedures for development and approval of Technical Corrigenda*. ISO TC184/SC4 N782.
- [22] *Project leader approval checklist*. ISO TC184/SC4/QC N194, 2001-06-05
- [23] *SC4 Organization Handbook*. ISO TC 184/SC4 N 974, 2000-01-13.
- [24] *SC4 Quality Manual*. ISO TC184/SC4 N1110, 2000-11-08.
- [25] *STEP (Standard for the Exchange of Product Model Data) Resource Integration: Semantic & Syntactic Rules*. ISO TC 184/SC4 N80. 1991-03-26.
- [26] *Supplementary directives for the drafting and presentation of ISO 10303*. ISO TC184/SC4 N537, 1997-03-30.

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